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THE SOCIETY FOR ELECTRICAL DEVELOPMENT.

The electrical industry, in the sense in which we use that term today, had its birth about 1880 and its age consequently can be reckoned as about one generation of mankind. While it is true that the electric telegraph was in considerable use before that time, the other applications of electricity were in their extreme infancy or were yet to be developed to the point of commercial success. The incandescent lamp and the telephone were newly put upon the market and the dynamo was in its early stage. Motors of a commercial form were almost unknown and another decade was required to demonstrate that the electric railway, which represented the first great application of the electric motor, could be a commercial success.

Every year since that time has seen an increased use of electric energy, until today the town which is not provided with a central station, electric railway and telephone service is regarded as very much behind the times. This development has been possible only through the colossal labors of engineers and inventors, as well as financiers and others, in providing the mechanical means for obtaining the desired results. The activities of the organizations of electrical men and electrical companies, such as the National Electric Light Association for example, have been largely concerned with technical questions which have occupied the minds of the engineer and operating manager.

The time has now arrived when the technical questions in the field of electrical industry may be regarded as upon a similar footing to those in other industries. Not that the problems of the electrical engineer are all solved, for this is by no means true, and we may look for a steady technical development in the electrical field in coming years as we have witnessed in the past. It is true, however, that the development of the industry on the commercial side must receive greater attention than it has in the past, and it is evident that much energy is to be expended in this direction in the near future. The last few years have seen the birth and extension in popularity of the Commercial Section of the National Electric Light Association, and this movement may be regarded as typical of our time.

It has been recognized by those elements in the industry which look to the future that some means should be adopted for still greater commercial de-

velopment in the electrical industry. This feeling has manifested itself in the organization of the Society for Electrical Development, which held its first conference in New York City last week. The principal object of this society is to stimulate the growth of the industry by furthering the use of electrical energy in every way possible, and in doing so it looks for the co-operation of all elements in the industry, including central stations, manufacturers, jobbers, dealers and contractors. The wide response with which the first call for the organization of this society has been received indicates a general recognition of its need and its possibilities and an intention upon the part of the various interests involved to give it the necessary financial support. While little or no solicitation has as yet been undertaken, a considerable fund of money has been accumulated and it is expected, when a definite program for activity can be placed before the electrical public, that this fund will be greatly increased by the contributions of those who have not yet subscribed their quota.

The general interest manifested in the conference which incorporated this movement as a going concern indicates not only a wide interest in its success, but also a large field for its activities. The many plans which have been brought forward for directing the energy of the Society indicate that there will be no dearth of opportunities in the effort to achieve the purposes of the Society. Aside from the definite purpose of stimulating the use of electric energy through the various forms of advertising, the assistance which the Society can give in co-ordinating and harmonizing the different elements in the electrical industry is very manifest.

That the various elements of the industry need harmonizing has been recognized for a long time, and there have been many efforts made locally to improve relations, especially between the central station and the contractor and dealer. That the interests of these two elements are at times conflicting no one can deny, and if the Society can succeed in obtaining general recognition for a definite field of operation for each, its achievement will not be a small thing. A perusal of the report of the meeting and especially of the discussion upon Wednesday afternoon, which is recorded on other pages of this issue, will show the attitude taken by the different classes above referred to. The practice of selling appliances or installing wiring below cost found no champion, and it was generally agreed that if a central station is to be an element in the field of electrical merchandising, it should do so upon a purely merchandising basis, which involves the sale of appliances at a figure which will include the cost of handling, advertising and every other element which enters into the total expense of placing the articles in the hands of the consumer.

In educating the industry within itself, as well as in stimulating demand from without, the Society for Electrical Development has a great field of operation and should become a factor of no little significance in the future development of the electrical industry in this country.

OVERHEAD EXPENSES.

In the electrical contracting business what is known as overhead expense is usually defined as the cost of doing business. It is a quantity made up of expenses which must be borne continuously every day in the year, and it includes such items as salaries of office assistants, rents, insurance, association dues, and the like. As long as any contractor keeps his business organization unchanged, items which may be legitimately classed as overhead expense remain practically constant from month to month; they are but little greater in the busiest times than in times when work is slackest, if indeed they are any greater at all then. There is, however, a very important relation between the contractor's method of doing business and his fixed expenses. Expressed in dollars per month, this quantity will obviously increase with any increase in the number of employees placed permanently on the payroll, or with an increase in any one of a dozen other items which it is hardly necessary to enumerate specifically. Thus it is within the power of the contractor to make the cost of doing business high or to keep it relatively low all the time.

There are not a few electrical contractors who make use of opportunities for adjusting overhead expenses in such a way as to cripple their own business. A misguided zeal for keeping running expenses low often leads them to deprive themselves of suitable quarters for their business, and of adequate clerical help for carrying it on properly. The trouble with such men is that they have not learned the important difference between the cost of doing business expressed in dollars per year or per month and this cost expressed as a given percentage of the receipts from the business done within the given period. To keep the latter quantity low is generally desirable. In fact, the ability to do so is sure evidence of business sagacity. It is the sort of thing that puts the annual balance in the right column in the ledger and makes it a balance of comfortable proportions. But in order to keep percentage overhead low it is often necessary to allow the monthly overhead to run relatively high.

But little less important than the matter just mentioned is that of making sure that each contract secured will bear its own proper, proportionate share of overhead costs. With careful accounting it is comparatively easy to determine what per cent of the total receipts from the business done, the cost of doing business was during a year or other period that has passed. It is generally possible, too, to make a fairly reliable estimate of the volume of business to be expected in an arbitrarily chosen future period, be this an approaching year or a month. When data of this kind are at hand there should be but little

trouble, as a rule, in estimating with satisfactory accuracy the allowance for overhead expense which should be made in bidding on any prospective job. Difficulties that arise when such data are accessible usually grow out of efforts to include in overhead charges items which could be taken care of better in other ways. Some contractors may be able, for example, to figure freight and cartage on supplies as an item of overhead expense, or perhaps to compute overhead on a man-hour basis, but in the average case it would appear to be by far the simplest and safest procedure to compute this charge as a fraction of the total amount of the contract price and to derive this fraction from carefully kept records.

Comments on overhead expense would hardly seem complete without some mention of the contractor who, because his business is small, assumes that his fixed expenses are negligible. That there are too many contractors of this sort is a matter of common knowledge among members of the craft. No business can be so small as this. Even in the case of the humblest member of the curbstone fraternity, overhead expense is a quantity that is very real, and the contractor who neglects it invites his own failure in business and at the same time imposes burdens on his competitors which is hard for them to have to bear. Once in a while when business is very dull some contractor may be justified in leaving the matter of profits out of consideration in bidding on a job. In not including overhead charges, though, a contractor is simply offering to give the customer money. There are better ways of exercising the spirit of charity.

SELLING ENERGY TO MUNICIPAL ELECTRIC PLANTS.

The development of hydroelectric transmission systems in well populated regions often encounters the established municipal plant in its progress and the problem of entering into mutually profitable relations in such cases is one of no small importance. There is no question that a carefully managed municipal electric service system free from political entanglements and supplying a town offering considerable new business as the reward of solicitation may be a highly desirable customer for the hydroelectric company, especially if arrangements can be made by which the existing generating plant of the community can be held as a reserve against abnormal conditions on the watersheds and streams upon which the power organization depends. Contracts along this line are being prepared widely, but the good work has so far attained only a small part of its ultimate possibilities and for that reason deserves renewed consideration.

In many cases the municipal plants to be dealt with are of comparatively small size, and on account of the character of their equipment, loads and fuel facilities are unable to produce electrical energy at as low a figure as it can profitably be supplied to them from the transmission system. In a typical instance under negotiation at this writing, the generating plant of a manufacturing town of about 12,000 inhabitants contains three units of 1,140 kilowatts combined rating, one machine being a 750-kilowatt steam turbo-alternator and the other two engine-driven generators of 150 and 240 kilowatts capacity. With a coal cost of $3.82 per ton, the manager figures the total cost of production for the past year at 3.8 cents per kilowatt-hour, including operating expenses and distribution costs at about 2.2 cents, interest at 4 per cent and depreciation at 5 per cent. The hydroelectric company approaching the community offers to furnish the town with electrical energy at a price close to two cents per kilowatt-hour, provided the station of the municipality can be held as an auxiliary at the expense of the company for a contract period of ten years. This means a saving to the town of approximately $1,000 a month and if accepted will obviate the early expenditure of funds for an additional 750-kilowatt steam turbine which will be needed in case proposed rate reductions are carried into effect to capture additional power business within the municipality and to improve the operating conditions in the latter's plant.

Whether the municipality accepts the offered servce, as now appears likely, or decides for the present to continue its plant as a generating station, the situation illustrates the importance of close figuring in dealing with problems of this character, and suggests the wisdom of a genuinely co-operative agreement where margins are narrow. It must not be forgotten in dealing with this class of prospective power customers that local points of view regarding concessions of apparently trifling importance to the outsider may well be heeded in the interests of closing a contract. Such questions as the supply of light in the principal square to an installation to be furnished by the incoming organization, the co-operative advertisng of the town by two or three illuminated billboards placed along the railway right of way, joining hands with the local merchants' association or of improving certain pole lines in good neighborhoods may at times be involved with the main issue of introducing the service into the community. To the executive of the power company, located as he may be behind a glass-topped mahogany desk in a distant city office building, some of these local ideas of give and take may not appeal, but the fact remains that after the price is fixed in the proposition, the human side of the problem must be solved. Long experience in dealing with shrewd boards of selectmen inclines the successful manager to the belief that what appeal to him as incidentals or non-essentials are sometimes regarded locally as of paramount importance, and may well be yielded in the interest of the larger economic gain. Probably there is no class of electric service solicitation where frank, open, face-to-face methods and full publicity bring a greater reward.

Denver Electric Show Planned.

All Colorado is aflame with interest in the proposed holding in Denver in 1915 "The Indian Pageant of America," which will be the last grand council of the aboriginal race of this country. At its regular weekly luncheon, held at the Albany hotel, Denver, on March 6, the Colorado Electric Club made known its plans to help with the entertainment and exposition which is to be offered.

The meeting of the club on March 6 was a special one to which members of the Chamber of Commerce, Colorado Publicity League and other well known civic organizations of the city were invited. October 4 to 11 of this year the club proposes holding in the Denver Auditorium its third annual electric show and at this luncheon the Colorado Manufacturers' Association was asked to join with the Electric Club in promoting the electrical exposition. Willis V. Elliott, a Denver attorney, and a member of the Electric Club, was chairman of the meeting and he made the announcement for the club, saying in part:

"In 1913 we propose to enlarge the scope of our electric show and we have met here today to extend an invitation to the Manufacturers' Association to join with the Electric Club to give an exhibition that will surpass all previous efforts. With the assistance of the Colorado Manufacturers' Association we will be able to stage one of the biggest electrical shows ever given in this country. The proceeds of the show will be devoted to the Colorado Publicity League, which has charge of the Indian Exposition, as the Electric Club's donation to a general fund which is being raised to promote the Indian festival."

In accepting the donation, J. M. Kuykendall, chairman of the Colorado Publicity League, complimented the Electric Club on the spirit it had shown in working for the betterment of Colorado and Denver.

Mayor Henry J. Arnold, who was present at the meeting, offered the Electric Club free use of the Auditorium, on behalf of the city. The offer was accepted.

The officers of the Electric Club are highly elated over the plan which the committee in charge of the third annual electric show has worked out. The price of admission to this year's electrical exposition will be reduced from 50 to 25 cents, and it is the general opinion that a fund of at least $50,000 will be raised for the Indian Pageant committee. The first show held by the Colorado electrical interests, earned 100 per cent, the gross receipts from the show being $40,000. The second netted the tidy sum of $30,000 and it is believed that the reduction in the admission fee will make the 1913 show more financially successful than any heretofore given.

If the fund raised by the Electric Club amounts to $50,000, that sum will bring the total amount of donations made to the Colorado Publicity League, by the local electrical interests up to $60,000.

When the plan for holding the Indian pageant was first announced, the Denver Gas & Electric Light Company, through its general superintendent, William J. Barker, gave $10,000 for the promotion of the plan, the money being the first financial assistance given.

Louisville Automobile Show.

Electric cars were a feature of the annual exihibition of the Louisville Automobile Dealers' Association, held in the Kentucky metropolis last week. The only wagon shown was the Urban electric truck, made by the Kentucky Wagon Manufacturing Company of Louisville, but there was a large and representative display of passenger cars, the electric division as a whole attracting much attention. Among the cars shown were the Chicago, exhibited by the Kentucky Auto Company; the Rauch & Lang, Hite D. Bowman; Waverly, A. E. Reid; Detroit, Southern Motors Company. Childers & Walters, of Louisville, had the contract for the installation of lighting equipment for decorative and illuminating purposes, as well as a number of motors used in demonstrating automobile devices.

Annual Convention of National Association of Electrical Inspectors.

The tenth annual meeting of the National Association of Electrical Inspectors will be held in New York, March 25 and 26. Hotel Flanders, 135 West Forty-seventh Street, will be convention headquarters. The convention dinner will be served here at 7 o'clock in the evening of March 25, and S. W. Stratton, director of the Bureau of Standards, Washington, and either the president or the vice-president of the Western Association of Electrical Inspectors will be present as guests. Thomas Henry Day, of Hartford, Conn., is the president of the National Association, and William Lincoln Smith, of Concord, Mass., is its secretary.

N. E. L. A. 1915 Convention to Be Held at San Francisco.

The convention of the National Electric Light Association in 1915, will be held at San Francisco, during the week of June 14 while the Panama-Pacific International Exposition is in progress. This was decided at a meeting of the Executive Committee held in New York City last month.

Meeting of Radio Engineers.

A paper by L. W. Austin of the United States Navy Department, describing some experimental extensions of his recent work on the variation with frequency of condenser resistances, was read at the regular meeting of the Institute of Radio Engineers, on March 5. Although Dr. Austin was unable to deliver the paper in person, the subject aroused much interest and brought about a lively discussion.

The design of an emblem was submitted to the Institute for final criticism, and it is expected that the form agreed upon will be ready for distribution at the next meeting on April 2.

The Institute of Radio Engineers which was formed by the consolidation of the Society of Wireless Telegraph Engineers and the Wireless Institute, is now well on in its second year. The membership is still growing rapidly and meetings are held on the first Wednesday of each month at Fayerweather Hall, Columbia University.

Pittsburgh Meeting of American Institute.

The April meeting of the American Institute of Electrical Engineers will be held in Pittsburgh, Pa., on Friday and Saturday, April 18 and 19, under the auspices of the committee which was recently appointed on the Use of Electricity in Mines, of which George R. Wood, consulting engineer of the Berwind - White Coal Company, is chairman. Headquarters will be at the Fort Pitt Hotel.

A number of interesting papers covering the various phases of this subject have been promised, and, owing to the meeting in the heart of the bituminous coal mining district, it is expected that the discussion will be participated in by a number of the practical mine operators.

S. W. Stratton in Council of Underwriters' Laboratories.

S. W. Stratton, director of the Bureau of Standards, Washington, has been elected to, and has accepted membership, in the council of the Underwriters' Laboratories, Chicago.

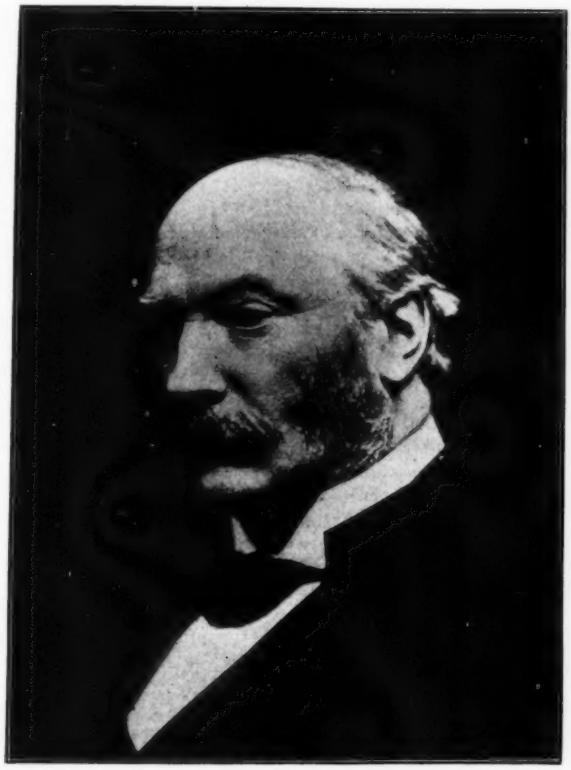
The council of the Laboratories is composed of 22 of the leading experts of the United States and Canada, who serve without compensation and supervise technical work of the institution.

The growing importance and extent of the work of Underwriters' Laboratories in connection with the general movement for reduction of the fire waste in America, together with some work in this field which the Government has outlined, make Dr. Stratton's appointment to membership in the Laboratories' council a particularly happy one at this time.

Lord Rayleigh.

In company with several distinguished workers in the domain of scientific investigation, John William Strutt, third Baron Rayleigh, has been awarded the Elliott Cresson gold medal by the Franklin Institute in recognition of his extended researches of signal importance in physical science. While Lord Rayleigh is perhaps best known for researches apart from his investigation of electrical phenomena, a great deal of his work has overlapped that of the investigator in things purely electrical, and much of what he has accomplished in the refinement of data and the perfection of instrumentalities for further discoveries in these directions has been of inestimable benefit to the development of the electrical industry.

John William Strutt was born in Essex, England, on November 12, 1842. He was educated at Trinity College, Cambridge, from which he was graduated as senior wrangler in 1865, obtaining the first Smith's prize of the year. From 1879 to 1884 he was Cavendish professor of Experimental Physics at the University of Cambridge; and in 1887 he accepted the post of professor of natural philosophy at the Royal Institution of Great Britain, which he resigned in 1905. From 1887 to 1896 he was secretary to the Royal Society. From 1892 to 1901 he was Lord-Lieutenant of Essex. In 1905 he became president of the Royal Society, retaining this office till 1908, in which year he was chosen to succeed the eighth Duke of Devonshire as chancellor of Cambridge University.



John William Strutt, Baron Rayleigh, English Physicist Awarded Elliott Cresson Medal.

Lord Rayleigh's early mathematical and physical papers, written under the name of J. W. Strutt, made him known throughout Europe.

A great part of his theoretical work has consisted in reinvestigating familiar subjects and elaborating their data into precision. In this way he has gone over a great portion of the field of physics, and in many cases has either brought the investigation to finality for the time being, or else has started new and fruitful development. The various branches of chemical physics, particularly capillarity and viscosity, theory of gases, flow of liquids, photography, optics, color vision, wave theory, electric and magnetic problems, electrical measurements, elasticity, sound and hydrodynamics, have especially felt his influence.

The numerous scientific memoirs in which his original work is set forth were collected under his own editorship in four large volumes, the last of which was published in 1903. His most extensive work is a book on "Theory of Sound."

As the outcome of a long series of delicate weighings and much experimental care in the determination of the relative density of nitrogen gas, Lord Rayleigh made, in collaboration with Sir William Ramsay, the discovery of argon.

He has taken much interest in abnormal psychological investigations, and became a member and vice-president of the Society for Psychical Research.

Lord Rayleigh was one of the original members of the Order of Merit, instituted in connection with the coronation of King Edward VII. He is a past-president of the Royal Society and a Nobel laureate, having been awarded the Nobel prize in 1904. He is an officer of the Legion of Honor.

It is the intention of the Tacoma Jovian League to make its meetings of practical interest to all engaged in the electrical industry and its allied trades. It is hoped thus to make the meetings of practical importance to all concerned.

Westinghouse Banquet.

The third annual banquet of the Westinghouse Club was held at the Hotel Schenley, Pittsburgh, Pa., on Saturday evening, March 8. It was attended by 589 men, representing practically all of the various Westinghouse interests. The list of speakers follows: C. A. Terry, vice-president, Westinghouse Electric & Manufacturing Company, acting as toastmaster; E. M. Herr, president, Westinghouse Electric & Manufacturing Company, "Introductory;" H. H. Westinghouse, president, Westinghouse Traction Brake Company, "History;" H. G. Prout, vice-president, Union Switch & Signal Company, "The Young Engineer and the Nation;" E. S. McClelland, Westinghouse Machine Company, "Miscibility;" Robert Garland, "Government of the City of Pittsburgh;" G. E. Tripp, chairman, Westinghouse Board of Directors, "The Public;" E. R. Craig, Westinghouse Air Brake Company, "Emos Sekarb."

The following were also seated at the speakers' table: C. F. Scott, E. H. Sniffin, J. F. Miller, H. T. Herr, S. L. Nicholson, W. G. Carr, J. C. Bennett, T. W. Siemon, H. P. Davis, B. G. Lamme, W. J. Longmore, F. A. Estep, W. A. Bold.

Tri-State Convention.

The second annual convention of the Tri-State Water & Light Association of the Carolinas and Georgia will he held at Charlotte, N. C., on April 15 and 16.

This association was organized at Columbia, S. C., in 1911. The president of the association is W. F. Stieglitz, Columbia, S. C., and the secretary is J. W. Neave, Salisbury, N. C. The program which is now being arranged will be announced later.

Supply and Machinery Associations' Convention.

The joint convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association, will be held at Indianapolis, Ind., on April 10, 11, and 12. The secretary of the latter association is F. D. Mitchell, 309 Broadway, New York City, who should be notified of the names of delegates to the convention.

Officers of National Independent Telephone Association.

At the recent annual convention of the National Independent Telephone Association, a full report of which was given in our issue of March 1, a board of directors was elected as usual and authorized to select the officers of the Association for the ensuing year. At a meeting of the board held in Chicago on March 3, all of the officers (with the exception of the second vice-president) were re-elected, as follows: President, Manford Savage, Champaign, Ill.; first vice-president, E. B. Fisher, Grand Rapids, Mich.; second vice-president, N. G. Hunter, Wabash, Ind.; secretary and treasurer, Richard Valentine, Janesville, Wis.; assistant secretary and cashier, Miss N. Thompson, Chicago, Ill. The board also selected from its membership the following named as its executive committee: Manford Savage, H. D. Critchfield, E. B. Fisher, N. G. Hunter, R. Valentine, L. D. Kellogg and J. B. Earle.

Examination for Electrical and Mechanical Inspector.

The United States Civil Service Commission has announced an open competitive examination for electrical engineering inspector to be held on April 2 and 3 at the usual places. From the resulting list of eligibles appointments will be made to vacancies in the Quartermaster's Corps of the Army at salaries ranging from $1,200 to $1,500 per year. Appointees may be detailed to serve in any part of the United States. The examination will cover mathematics, drawing, theory and practice of electrical engineering; with 35 per cent of the credits based upon training, experience and general fitness.

The duties of such inspectors consist in requiring contractors to carry out the plans and specifications for electric distributing systems, lighting plants, interior wiring, etc., done under contract for the War Department. At least three years' practical experience is a prerequisite. Graduation from a technical school is considered equivalent to one year's experience.

On April 16 and 17 the Civil Service Commission will hold an examination for mechanical engineering inspector at similar salaries. Examination subjects differ by the substitution of theory and practice of mechanical engineering in place of electrical engineering. The duties are similar. Applicants for either of these positions should secure Examination Form 1312.

Increase in Niagara Power.

Owing to the expiration of the Burton law, limiting the diversion of water from the Niagara River, the power companies operating at Niagara Falls, N. Y., made additional diversions of water on March 5. The Niagara Falls Power Company is said to have increased its output by 20,000 horsepower and the Hydraulic Power Company by 54,000 horsepower.

California Petroleum in 1912.

The production of petroleum in California in 1912 increased to 87 million barrels, from 81 million barrels in 1911. A number of good producers in the Midway and other valley fields were ruined by an influx of water, which turned the oil to a valueless emulsion. Consumption increased so that the additions to stocks were not as great as was expected. The total stock at the end of 1911 was 44,240,118 barrels. This increased to 48,000,000 barrels at the end of 1912, a gain of less than 4,000,000 barrels, while production increased 6,000,000 barrels, showing that the consumption in 1912 was over 2,000,000 barrels greater than the production of 1911.

The features of particular interest during the year were the development of large wells at unusual depth in La Habra field, the continued development of large gushers in the valley fields, the decline in the old Santa Maria field, the extension of the Coalinga territory by the development of good wells to the south, the increased utilization of natural gas including the enterprise for piping natural gas from the valley fields to Los Angeles, and the increased amount of gasoline obtained by compressing natural gas. Progress was also made, especially in the Midway field, in cracking crude oils to obtain greater yields of gasoline.

Electrical Exports for January.

The Bureau of Foreign and Domestic Commerce, Washington, D. C., has issued its monthly summary of the imports and exports of the United States for the first month of this year. From these statistics have been taken the following data relative to the electrical exports.

The figures for January show that the total value of electrical shipments was very near to the new record established in November of last year and nearly half a million dollars greater than in January, 1912. In the following table the January figures are given according to the official classification now in vogue:

Articles	No.	Value.
Dynamos or generators		$165,469
Motors		876,864
Fans	1,496	29,771
Arc lamps	287	5,850
Carbon-filament lamps	164,638	29,185
Metal-filament lamps	119,915	29,509
Telegraph instruments (including wireless)		9,458
Telephones		83,952
All other		1,487,567
Total, January, 1913		$2,217,625
Total, January, 1912		1,721,269

National Carbon Company in Jovianism.

The National Carbon Company, Cleveland, O., holds the unique record in Jovian enterprise, 54 of the members of its executive and sales organization being members of the Jovian Order. These 54 Jovians hold stated meetings and are in evidence at rejuvenations and conventions in every part of the country. A well trained degree team has been organized. At a recent meeting of the Chicago Jovian Lunch Club a letter from the National Carbon Jovians was read, offering to bring its degree team to Chicago to assist in the rejuvenations which will be held at the National Electric Light Association convention in June. This so stimulated the interest and competitive spirit of the Chicago Jovians that it was voted to begin immediately upon the training of a degree team proper for the occasion. Nelson C. Cotabish, sales manager of the National Carbon Company, is a Jovian of long standing, having joined the order at Niagara Falls in 1906. The offer of the National Carbon Jovians created considerable discussion and a good deal of humorous comment, and L. W. Fischer, representing the company, who was present, was properly insulted when it was inferred that the "boss" was a Jovian who "made" all the others belong.

At the meeting of the Jovian Lunch Club of Chicago at the Grand Pacific Hotel on February 24 a large number of delegates attending the sales conference of the Western Electric Company were in attendance. Tom Bibber of New York delivered a brief address, in which he urged the Chicago Jovians to organize a degree team which could compete with the New York team for the prizes offered.

New Lighting Company for Macon, Ga.

On March 1, the Georgia Public Service Corporation placed in operation its new steam-turbine plant, which gives to Macon two central-station companies. The new plant is of 2,500-kilowatt capacity, with an ultimate capacity of 5,000 kilowatts, although the design of the station provides that additional units may be installed as conditions require.

Long Distance Wireless Signal.

It is reported from the Naval Radio Station at Newport, R. I., that wireless signals being exchanged between two stations in the Argentine Republic have been received at Newport. This involves transmission over about 6,000 miles. The atmospheric conditions of March 4, when these signals were observed, were exceptionally favorable.

Electricity in Carriage and Wagon Works.

The ability of the central-station company to sell energy to carriage and wagon works depends, to a large extent, upon the proper utilization and disposal of the waste. This article discusses the advantages of motor drive, giving figures on the economy of central-station power, and presents data on several typical installations.

From the standpoint of the central-station company, plants devoted to the manufacture of carriages and wagons do not differ materially from other woodworking establishments. Wood refuse, varying in amount with the size of the plant, is available for fuel and as the coal bill is often a small item of the plant's total operating cost, where this refuse is burned, the plant manager usually feels that no economy can be effected by purchasing power. In soliciting the adoption of electric drive for such plants, therefore, a great proportion of success depends upon the ability on the part of the central-station power salesman of correctly analyzing existing plant-operating expenses and fixed charges. Ability to do this readily and correctly will go far to demonstrate definitely and convincingly to a prospect the flaws and waste and general field for improvement in power layout.

It is true, however, that the ability of the central-station company to furnish energy to carriage and wagon factories at an attractive figure depends, to a large extent, upon the proper utilization of the waste. Experiences of innumerable plants, in this connection, have shown that a ready market can be found for all waste, selling both kindling and baled shavings, and where the income from this is not sufficient to pay for the entire amount of power purchased from the central station, it reduces power bills to such an extent that the cost of steam power, in comparison, is out of the question. Of course, the demand for waste varies in different localities but some market can be found in the great majority of instances. In Louisville, Ky., hard-wood refuse from several plants purchasing power is sold to the local bakeries, at a good price. In Menominee, Mich., a plant has recently been built to convert sawdust into cattle food. The process involves cooking the sawdust, adding molasses and mixing the resultant product with alfalfa. The food is claimed to be an excellent one for milch cows, etc. This plant purchases sawdust from a number of woodworking plants using central-station power. In other localities, shavings can readily be sold for bedding, sawdust to ice and refrigerating companies, sticks and shorts for kindling, etc.

Sticker in Factory of Wayman & Murphy.

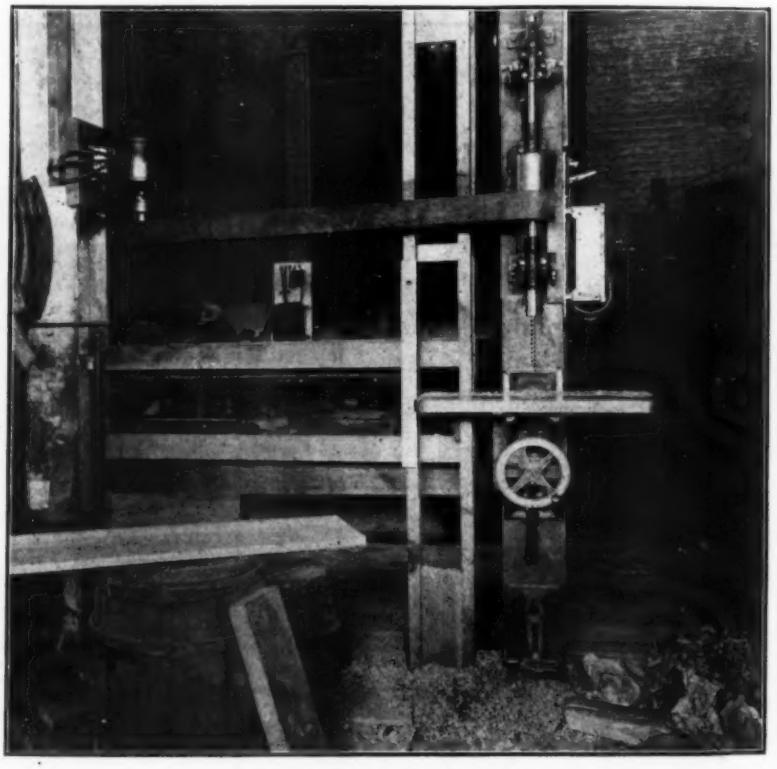
Much has been written, also, regarding the distillation of wood. One writer estimates that from one cord of hard wood, weighing 4,000 pounds, the following products can be obtained:

	Market Value
Charcoal, 42 bushels; per bushel....	$0.05
Wood alcohol, 10 gallons; per gallon	0.25
Acetate of lime, 200 pounds; per pound.....	0.015
Tar oils, 8 gallons; per gallon.....	0.08

On this basis the average money return per cord is $8.24 against which the distiller is at the present time paying from $3.50 to $3.75 a cord for material.

It would seem from the above figures, which are conservative, that the field is there waiting for exploitation. This, indeed, has been proven by a steady increase in the number of distillation plants and the establishment of plants at places where cheap refuse is available. At the present writing a plant is being equipped at Memphis, Tenn., designed to accomplish this very thing. The question whether the waste of the woodworking industry of the future will be of more value than that of the past will depend upon the relation of the cost of handling this miscellaneous material through the processes which give it this increased value.

Emery Wheels.



Motor-Driven Boring Machine.

Advantages of Motor Drive.

There are a great many advantages of motor drive that apply to all woodworking plants and therefore are of importance when considering the electrification of carriage and wagon shops. A few of the more important ones are discussed herewith. In the majority of plants the equipment is usually the same as that found in any woodworking establishment, with the addition of a forge and machine shop for manufacturing the metal parts used in the construction of carriages and wagons.

The ideal attainment of modern production is a maximum output from a given investment in plant and machinery. Electric power, in so far as it contributes to this result, is being given an ever-increasing degree of attention where woodworking machinery is used, as experience under the severest service conditions has proven that it possesses advantages of efficiency and economy that meet most successfully the peculiar conditions of the woodworking industries. It has been demonstrated under the severest service conditions that the electric motor renders possible the most economical approach to the direct application at the machine of the total initial power developed. Also, the better lighting and ventilation, the greater freedom from dust and lessened danger of physical injury, resulting from the removal of belts and shafting, have been found by experience to increase the productive efficiency of the employee.

An important feature of individual motor drive is the ability to operate any group of machines or any separate machine overtime or at unusual hours without putting the entire plant in operation. This feature is, of course, of especial importance when energy is supplied by a central station, as in that case the cost of operating any machine stops when the machine does.

The space economy of individual motor drive is also of particular importance in carriage and wagon works due to the size of the product handled. When machines can be placed regardless of lineshafts utilization can be made of the available floor space to the best advantage.

One of the important arguments to be remembered by the central-station power salesman is the marked reduction in fire risk where central-station power is used. If power is obtained from an adjacent steam plant the fire risk is great and insurance rates correspondingly high. Mechanical drive necessitates either the dangerous proximity of the boiler room or heavy losses in long steam mains or rope transmission. If central-station power is used, all danger from adjoining power plant is removed; in any case, electric drive not only does away with the inflammable dust inevitably carried into the engine room by the large belt, but also makes possible the complete isolation of engine and boiler

Carriage and Wagon Works Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Prouty-Glass Carriage Company, Wayne, Mich. This plant manufactures carriages and cutters, having an average output of 9,000 vehicles—3,500 carriages and 5,000 cutters. Running hours per week, 54.

Connected horsepower, 153. Total number of motors installed, 43. Average kilowatt-hours per month, 6,043.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	8,700	May	6,560	September	4,590
February	8,170	June	4,000	October	4,170
March	10,910	July	5,050	November	3,960
April	9,620	August	4,900	December	1,890

Load-factor, 7.3 per cent; operating-time load-factor, 18 per cent.

The average electrical energy consumption per vehicle manufactured is 8.057 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. The capacities of the driven machines vary.

No.	Horse-power.	Speed R. P. M.	Pulley Size Inches		Application.
			Motor	Machine	
1	15	1,800	7	12	Belted to sticker.
1	7.5	1,800	8	28	Belted to band saw.
1	7.5	1,800	5	5	Belted to planer.
1	7.5	1,800	5	5	Belted to planer.
1	5	1,800	4	18	Belted to sander.
1	5	1,800	10	3	Belted to shaper.
1	5	1,800	6	4	Belted to cut-off saw.
1	5	1,800	5	12	Belted to mortising machine.
1	5	1,800	5	28	Belted to cut-off saw.
1	5	1,800	7	12	Belted to sander.
1	5	1,800	8	8	Belted to drill.
1	3	1,800	6	12	Belted to tenoning machine.
1	3	1,800	6	12	Belted to jointer.
1	3	1,800	10	3	Belted to shaper.
1	3	1,800	5	23	Belted to bending machine.
1	3	1,800	5	26	Belted to elevator.
1	3	1,800	5	24	Belted to sand belt.
1	3	1,800	7	4	Belted to rip saw.
1	3	1,800	4	6	Belted to drill.
1	2	1,800	3	2	Belted to chuck.
1	2	1,800	4	10	Belted to rounder.
1	2	1,800	4	12	Belted to gainer.
1	2	1,800	4	8	Belted to drill.
1	2	1,800	4	10	Belted to sand belt.
1	2	1,800	6	8	Belted to rip saw.
1	2	1,800	4	12	Belted to band saw.
1	2	1,800	4	10	Belted to emery belt.
1	2	1,800	4	16	Belted to emery wheel.
1	2	1,800	4	44	Belted to elevator.
1	2	1,800	5	26	Belted to rimmer.
1	2	1,800	7	4	Belted to cut-off saw.
1	1	1,800	4	14	Belted to drill.
1	1	1,800	3	5	Belted to drill.
1	1	1,800	3	36	Belted to punch.
1	1	1,800	3	16	Belted to drill.
1	1	1,800	3	22	Belted to threader.
1	1	1,800	5	4	Belted to fan.
1	1	1,800	4	30	Belted to paint mixer.
1	1	1,800	3	8	Belted to cut-off saw.
1	1	1,800	4	12	Belted to sewing machine.
1	20	1,200			Belted to blower (not in use).
1	7.5	1,800			Belted to rip saw (not in use).
1	2	1,800	Not in Use.		

Virginia Carriage Factory, Roanoke, Va. This is a small factory that previous to the installation of motors did all work by hand. The company does a large repair business, in addition to the manufacture of carriages. Total connected horsepower, 12. Total number of motors installed, 3. Average kilowatt-hours per month, 174. Load-factor, 2.7 per cent.

Kilowatt-hour consumption for 12 months: January, 101; February, 123; March, 148; April, 197; May, 181; June, 194; July, 183; August, 167; September, 169; October, 176; November, 183; December, 168.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts, and 220 volts direct current.

No.	Horse-power.	Speed R. P. M.	Application.
1	5	1,700	Shunt-wound motor belted to line shaft driving two drill presses; and one emery wheel.
1	2	1,900	Shunt-wound motor belted direct to forge blower.
1	5	1,800	Squirrel-cage motor belted to line shaft driving one band saw; one jointing machine and one grind stone.

Carriage and Wagon Works Data—Sheet No. 2.

Oklahoma Carriage Works, Oklahoma City, Okla. This plant manufactures carriages and wagons, operating 56 hours per week.

Total connected horsepower, 12.5. Total number of motors installed, 2. Average kilowatt-hours per month, 524. Average kilowatt-hours per month per connected horsepower, 42. Load-factor, 9 per cent.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	590	May	524	September	570
February	486	June	638	October	446
March	472	July	690	November	516
April	478	August	500	December	398

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, direct current.

No.	Horse-power.	Speed R. P. M.	Application.
1	7.5	1,625	Belted to a line shaft driving one small drill press; one trip hammer; one two-spindle emery wheel; one small punch, and one forge blower.
1	5	1,650	Belted direct to one cut-off saw.

Energy is supplied by the Oklahoma Gas & Electric Company.

Carriage and wagon factory located in Chicago, manufacturing, principally, light delivery wagons.

Total connected horsepower, 57.5. Total number of motors installed, 22. Average kilowatt-hours per month, 3,295. Load-factor, 12 per cent.

Kilowatt-hour consumption for 12 months: January, 4,750; February, 2,440; March, 3,130; April, 3,220; May, 3,170; June, 3,100; July, 2,830; August, 2,750; September, 2,670; October, 4,700; November, 3,750; December, 3,030.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	7.5	800	Belted direct to elevator.
1	2	1,650	Belted to emery grinder.
2	2	1,100	Each belted direct to trip hammer.
4	0.5	500	Belted direct to small drill presses.
1	3.5	1,600	Belted to shafting driving punch and shears.
1	3.5	1,600	Belted direct to shaper.
1	2	1,650	Belted direct to cut-off swing saw.
1	2	1,600	Belted direct to tenoning machine.
1	2	1,500	Belted direct to sander.
1	3.5	1,600	Belted direct to planer.
1	2	1,650	Belted direct to boring machine.
1	1	740	Belted direct to thread cutter.
1	7.5	830	Belted direct to hydraulic press.
1	2	1,600	Belted direct to band saw.
1	3.5	1,650	Belted direct to rip saw.
1	3.5	1,650	Belted direct to jointer.
1	5	900	Belted direct to hub-boring machine.
1	1	1,000	Belted direct to tire-bending machine.

Energy is supplied by the Commonwealth Edison Company.

Wagon works, having an average output of 16 spring wagons and 50 wheelbarrows per month in addition to doing a general repair business. There are eight men employed working 10 hours per day.

Total connected horsepower, 30.5. Total number of motors installed, 15. Average kilowatt-hours per month, 496. Load-factor, 3 per cent; operating-time load-factor, 7 per cent.

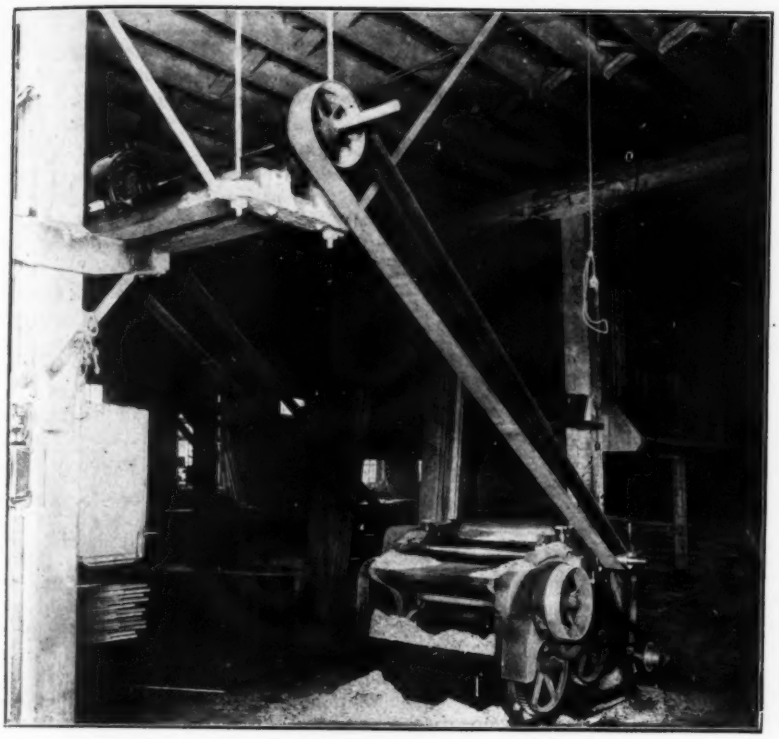
Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	495	May	476	September	438
February	682	June	457	October	439
March	584	July	415	November	601
April	476	August	383	December	505

MOTOR INSTALLATION.

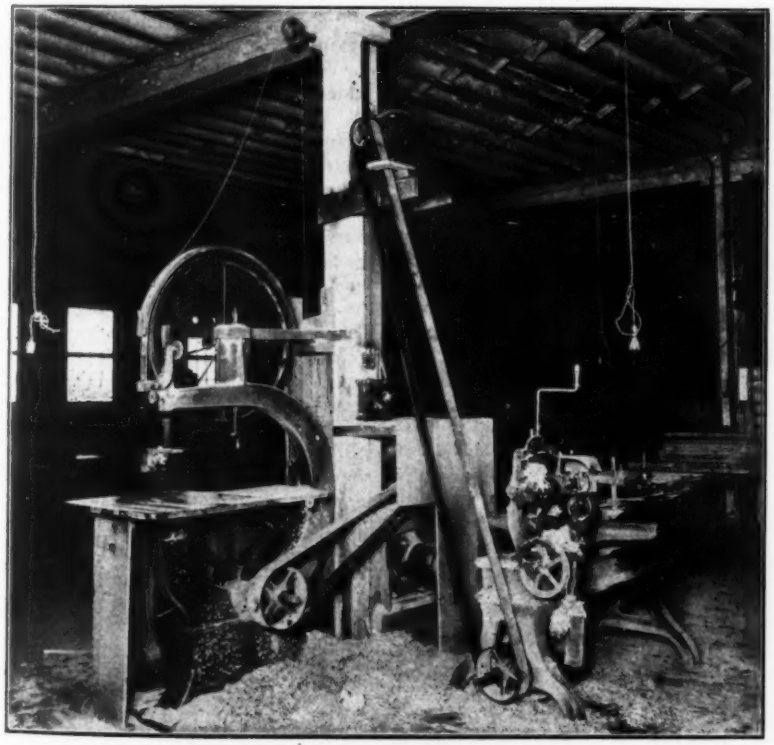
The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	2	1,700	Belted to a J. A. Fay & Egan jig mortiser with drill attachment.
1	1	1,700	Belted direct to 36-inch drum sander.
1	0.5	1,800	Belted to 12-inch double emery wheel.
1	1	1,700	Belted to L. Powers & Company No. 0 boring machine.
1	2	1,700	Belted to L. Powers & Company 20-inch jointer.
1	5	1,700	Belted to H. B. Smith 24-inch planer.
1	3	1,200	Belted to 48-inch band saw.
1	5	1,700	Belted to 18-inch self-feed rip saw.
1	1	1,700	Belted direct to 16-inch drill press.
1	1	1,700	Belted to 12-inch double emery wheel.
1	1	1,700	Belted to small shear and punch.
1	2	1,700	Belted to 4 by 7-inch roll-tire bender.
1	1	1,700	Belted to 26-inch drill press.
1	2	1,700	Belted to 800-pound Giant trip hammer.
1	3	1,700	Belted to No. 2 Buffalo forge blower.



Motor-Driven Planer.

either by means of solid fireproof walls or by their installation in a separate building. The elimination of heavy lineshafts greatly reduces the danger of fire from overheated journal boxes or from spontaneous combustion of accumulated oily waste or shavings. It should be remembered that the rate charged by insurance companies, especially where steam boilers are in close proximity to the working machines, is exceedingly high, and that by installing complete electrical equipment in a modern fireproof building the annual premiums may be reduced from perhaps 7 or 8 per cent to three-quarters or one per cent. In many cases the savings in premiums will go far in making up for the original cost of the electric installation.



Motor-Driven Band Saw.

Other points to be borne in mind by the solicitor are: electric drive permits uninterrupted operation of tool and the attainment of high shop "time factor;" improves quality of product, as good product from woodworking machinery is largely dependent upon a drive capable of transmitting even and constant torque to the cutting tool; economizes unit cost of product, either by increasing product with a given equipment and personnel, or by direct economies in those charges debited exclusively to power; eliminates shafting and belting, allowing better placing of driven machines and reducing to a minimum the dissemination of sawdust and flying particles; permits the maximum return from those machines whose productive capacity is largely dependent upon the proper maintenance of speed and power, etc.

Selection of Motors.

The selection of motors for service in carriage and wagon factories presents no especial difficulty. In general the requirements can be met successfully by constant-speed motors and preference should be given the simple squirrel-cage type of polyphase induction motor, as the working conditions in wagon shops permit the motors to be started in most cases under light loads. Any demand for variable speed can be met by one of the several forms of pole-changing multi-speed induction motors which are now available.

Owing to the high speed and light moving parts of woodworking machines and the frequent violent application of the load, it is desirable to use belt drive rather than gears or chains, especially as the speed of the driven pulley is usually too high to permit of other than direct or belted connection. The direct drive is coming into vogue in many modern plants and is giving excellent results where the motor has sufficiently generous rating to accelerate rapidly and to withstand overloads. As the average depreciation of belting averages 36 per cent per year, it is important to reduce this waste and furthermore do away with any source of slippage between the driving unit and the working pulley.

In the installation of motors in carriage and wagon shops, if belts are used, it is strongly recommended that they do not run vertically or have so decided a vertical component as to minimize the arc of contact on the driving pulley and at the same time

prevent the use of the belt-tension adjustment on the motor base. Motors may often be conveniently located in an inverted position beneath the floor bearing the machine. If this method is adopted the belt between the motor and machine should be boxed in and the drive arranged as above stated, at a sufficient angle to be able to make use of the belt-tightener arrangement. There is a wide opportunity for the power salesman to use his ingenuity in the layout of novel methods of drive.

Cost Data.

No better illustration can be given of the advantages and economies of electric drive than in cases where it forces competing motive powers out of business in the face of unusually low fuel costs. In this connection the following particulars are given of the successful introduction of central-station power in a representative wagon factory, the adoption of electricity having been effected on the basis of a lower operating cost per year than the original steam plant, even when refuse sawdust and shavings were burned under the boilers.

The local central-station organization in this particular case pointed out that the ideal arrangement for the use of electric energy is a separate motor for each machine, but suggested that when the energy saving by this method ceases to pay 15 per cent on the investment it is not a success from a strictly financial point of view, although the cleanliness, convenience and flexibility of such an installation sometimes make it more desirable.

An analysis of the conditions prevailing under steam operation were found to be as follows:

	Horsepower
Maximum load on day of test	20
Average total load on day of test	8.8
Friction load on day of test	5.5
Average total productive load on day of test	3.3

The average total productive load if the machines had been fully loaded during the entire time on the test, not including the 5.5 horsepower of friction would have been 7.96 horsepower. This figure was used in the cost estimates which drove the steam engine from the plant, rather than the actual average productive load. From the records of the lumber company the following yearly costs of steam power were reduced for two successive years; first year, $1,176; second year, $1,366, giving an average of $1,271, or $106 per month. The principal items were coal, averaging $600 per year, and engineer's wages, average, $526 per year, other small items being oil, waste packing, engine repairs and miscellaneous. None of these small items much exceeded $40 per year individually.

The average load used in the estimated cost of electric service was based on the supposition that all machines not used during the day of test were operated at their maximum capacity for the entire time that the machines were in service, as the machines were only operating under a maximum load for approximately 50 per cent of the time that they were in operation. A large amount of saving was apparent in the estimated cost of electrical service.

The motors in this mill were arranged as follows:

	Horsepower	R. P. M.
First Floor—Individual Drive—		
Rip saw	5	1700
Planer	10	1700
Sticker, 12-inch	10	1700
Swing saw	3	1700
Second Floor—Individual Drive—		
Planer	7.5	1700
Sticker, 6-inch	5	1700
Rip saw	5	1700
Joiner	3	1700
Dado saw	3	1700
Band saw	3	1120
Group Drive—		
Tenoner, mortiser	5	1700
Sander, emery wheel, grindstone	5	1700

All motors are three-phase, 60-cycle, induction machines.

The average load of 7.96 horsepower hours per day with 26 days' service per month was 1,240 kilowatt-hours and at 4.6 cents per kilowatt-hour the energy cost was $57.10 per month, to which was added oil at $1.50, so that the total yearly cost of electrical operation was $703, compared with $1,271 for steam. The estimated saving by the use of electricity was, therefore, $568 per year, and this led to the installation of the motor drive as indicated above.

The old steam plant was given additional advantages in determining the relative yearly cost of operation, and still electricity was shown to be preferable. Thus the electrical costs were figured upon a total operation of 312 days per year against an actual service by the old steam plant of 256 days. The average number of workman-hours with steam drive was 24.5 per day while with electricity this came to 36. The estimated cost of motors was $1,219 installed, the cost of placing the motors at the mill door being $1,080, material to be used in the installation work, $108 and the labor of wiring, $31.

The installation of the electric drive resulted in the elimination of the main shaft and three auxiliary lines of shafting, besides cutting out 15 belts of varying length and sizes. The results of the first year's operation were as follows:

Total cost of energy	$419
Maximum bill for any month	$ 55
Maximum kilowatt-hours for any month	920
Minimum bill for any month	$ 33
Minimum kilowatt-hours for any month	220
Maximum demand	16.5 horsepower

In the accompanying data sheets will be found the detailed motor layout of several typical installations showing the horsepower required for various drives and the energy consumed.

Meeting of Chicago Section, Electric Vehicle Association.

The Chicago Section of the Electric Vehicle Association of America held its weekly meeting in the rooms of the Traffic Club on Tuesday, March 11. About 20 members were present and while no papers were read, those who attended heard a lively discussion on the garage situation as related to the charging of commercial vehicles.

The question of having some sort of a school for chauffeurs and battery men came before the meeting, the general opinion being that such an institution, or at least some sort of educational work carried on by garages among their employees, would be of enormous benefit to the electric-vehicle industry in general.

A case cited by G. V. McDowell brought out very well the fact that the practice of making a flat rate for charging and taking care of commercial vehicles resulted at times in the vehicle receiving an insufficient charge. Two vehicles which he mentioned in this connection were of different makes, although they were both kept at the same garage. Each one ran only about fifteen miles on a charge, and as a result the owner complained that there must be something the matter with the batteries, whereas it developed in the case of both machines that only half the proper charging current had been used and this was only put on for about six hours. A similar case was mentioned of garage owners who prohibited any vehicle from receiving current over 25 amperes, no matter what the requirement.

Mention was made of the fact that the American Express Company is planning to sell at auction all of its horse-drawn vehicles in the city. The horses have already been disposed of.

Arrangements were made for a committee to look into the matter of a special joint meeting of the Garage Owners' Association of Chicago and the Chicago Section of the Electric Vehicle Association. At this meeting, which is to be held soon, the matter of rates will be taken up. There has been some discussion as to just what charges should be made for cleaning, storage, etc., and whether the whole should be furnished at a fixed rate per month or whether the cleaning, storage, oiling, etc., should be supplied at a flat rate and energy sold at certain price per unit to the vehicle user. There is much to be said in favor of the latter method and it is probable that this will be adopted finally by the two societies.

The total copper production in the state of Washington in 1912 was about 1,250,000 pounds.

Commercial Practice
Management, Rates, New Business

ENGINEERING REPORTS ON ISOLATED PLANTS.

By A. S. Witmer.

Many central-station companies have arrived at a period where new power business comes slowly. The small manufacturers have become customers. Those of the larger ones, too, whose power requirements were such that purchased power was obviously cheaper. The little troublesome gas and gasoline plants, probably, have been "cleaned up." Now remains the man who needs steam in his factory; the man who has a large area requiring heat six months or more in the year; the factory that produces a by-product that makes good fuel; the man that sells a little light and power to his neighbors; and, most difficult of all, the man who has just recently installed a new plant.

It is such cases as those mentioned that power companies must look to for future business, if the rapid rate of growth of the past decade be maintained.

Some such business can be secured through careful and systematic work and close analysis of operating details.

A report worked up with close attention to details and carefully compiled will command the attention of a manufacturer who is operating an isolated plant.

Such a report can be made valuable by including suggestions for improving operating conditions by which the unit cost of production can be reduced.

This may be done by reducing the costs or by increasing the output without proportionally increasing investment on operating costs. A brief synopsis of a report of this character is given below.

This may be enlarged considerably to suit specific cases, but should be not too lengthy. It should appear as the production of a disinterested engineering house, contain true facts and not show undue prejudice in favor of central-station power. Cases will arise where central-station power will show up as a disadvantage, sometimes very decidedly so. However, even in such cases, there will come a time in the future when conditions will change and the power company will be called into consultation as a result of a report which, on account of its neat appearance and fund of information contained, was never relegated to the waste basket.

The synopsis given below is aimed to cover the work only in a general way. Much detail can be added. The more comprehensive the report, the more valuable it will be to the company and prospect.

Section VI is intended to cover the operating condition in analytical form and to be supplemented by Section VII where the results obtained are tabulated in exact figures.

Section XII can be much enlarged and the particular points of advantage to be gained by the plant under consideration should be strongly brought to the surface.

SYNOPSIS OF ENGINEERING REPORT ON ISOLATED PLANT.

I. Introduction.
  1. Name of company.
  2. Officers of company.
  3. History of plant.

II. Date of Report.

III. Location.
  1. Company's office.
  2. Factory and plant.

IV. Object of this Report.

V. General Operating Conditions.
  1. Output of plant.
    a. Kind of business.
    b. Capacity.
    c. Average output.
    d. Time plant operates.
  2. Buildings.
    a. Number.
    b. Size.
    c. Relative location.
    d. Uses.
  3. Machinery.
    a. Location.
    b. Arrangement.
    c. Means of driving.
  4. Special condition.
    a. Need of steam for manufacturing purposes.
    b. Fuel obtainable from plant refuse.
  5. Heating.
    a. Number, size and construction of buildings heated.
    b. Radiating surface.
    c. Time heat is required.
  6. Refrigeration.
    a. Tons ice and refrigeration required.
    b. Time it is required.

VI. The Power Plant and Its Operation.
  1. Boiler plant.
    a. Description of boilers.
    b. Description of auxiliary apparatus.
    c. Fuel, kind and method of handling.
    d. Water, where obtained.
    e. Method of handling ashes.
  2. Engine room.
    a. Description of prime movers.
    b. Description of generators and controlling apparatus.
    c. Relative light and power load.
  3. Results of tests made.
    a. Boiler.
    b. Engine.
    c. Generators.
    d. Heating system.
    e. Steam for manufacturing.
    f. Waste products used for fuel.
  4. Deductions made from results of tests and conditions of operation.
    a. Fuel.
    b. Water.
    c. Oil, waste, packing, etc.
    d. Wages.
    e. Insurance.
    f. Repairs.
    g. Lamp maintenance.

VII. Present Cost of Operation.
  1. Fixed charges.
    a. Interest on power plant investment.
    b. Depreciation on power plant investment.
    c. Insurance and taxes on power plant.
    d. Rental value of space occupied by plant.
    e. Decreased rental value of space made less desirable by heat of plant in summer, and vibration.
    f. Excess insurance on buildings and contents on account of proximity of power plant.
    g. Risk of damage to employees and public through accidents and boiler explosions.
  2. Operating expenses.
    a. Fuel.
    b. Water.
    c. Oil, waste, packing, etc.
    d. Wages.
    e. Cost of removing ashes.
    f. Cost of boiler compound.
    g. Repairs to machinery.
    h. Maintenance and cleaning of boilers.
    i. Repairs and maintenance of belts.
    j. Cost of changes in piping, pipe supplies, etc.
    k. Tool account.
    l. Lamp maintenance.
    m. Cost of breakdown service purchased.
    n. Value of time lost account failure of isolated plant power.
    o. Superintendence.
    (Total cost of operation.)

VIII. The Proposed Electrical Installation.
  1. Motors.
    a. Sizes.
    b. Arrangement and location.
  2. Wiring and control of motors.
  3. Elevator and special machinery.
  4. Current characteristics.

IX. Cost of Proposed Installation.
  1. Motors and accessories.

2. Wiring and installation.
3. Millwright work.

X. Salvage Value of Discarded Apparatus.

XI. Cost of Operation by Central-Station Service.
1. Fixed charges.
   a. Interest on investment.
   b. Depreciation on investment.
   c. Insurance and taxes on electrical equipment.
2. Operating expenses.
   a. K. W. H. consumption and cost.
   b. Oil and miscellaneous expenses.
   Total cost of operation.

XII. Comparison of Central-Station Service Versus Isolated Plant.
1. General advantages of Central-Station Service and motor drives.
   a. Saving in cost.
   b. Simplicity of extensions and changes.
   c. Continuous operation.
   d. Operation of plant not dependent on an engineer.
   e. Elimination of belts and shafting.
   f. Portion of plant not in use, entirely shut down.
   g. Increase in output due to constant speed.
   h. No danger of boiler explosion.
   i. Saving in space.
2. Special advantages gained in plant under consideration.

XIII. Free Engineering Service.

XIV. Summation and Conclusion.

A Unique Example of Co-operative Electrical Advertising in Newspapers.

The idea of having a whole newspaper devoted to electricity and known as the People's Electrical Page, or by some similar title, is not new. In Bay City, Texas, however, such a page is being operated under conditions which are, to say the least, unusual. The central station in Bay City, a town of only 4,500 population, is the Bay City Ice & Light Company. When this company was recently acquired by a syndicate, W. C. Duncan, a central-station man who had excellent commercial experience at Leavenworth, Lawrence, and Parsons, Kansas, was sent to Bay City as manager. He immediately set to work in true Texas style to "liven things up" and undertook the seemingly forlorn task of running an electrical page three times a week in a small town without any electrical contractors. His first encouragement came from the newspaper itself, which offered very reasonable advertising rates in consideration of the fact that a whole page was to be contracted for. For advertisers, Mr. Duncan had to go to the large electrical jobbers of Texas with the result that space in the Bay City Electrical Page was taken by the Southwest General Electric Company. Editorial and news matter for the page was supplied gratis by the National Quality Lamp Division of General Electric Company, Cleveland.

Mr. Duncan claims distinction for the Bay City Electrical Page on four grounds; first, the smallness of the community; second, the lack of contractors, who, in the larger cities are generally glad to co-operate; third, it is believed to be the first electrical page in Texas; and fourth, no other known electrical page appears at such frequent intervals.

Chicago Central-Station Institute Established.

The demand for trained men for the commercial department of large electrical concerns has led a number of

Club House of New York Edison Employees.

Chicago men to establish the Chicago Central Station Institute. It is the intention to train students by classroom work and outside experience, so that they may be better equipped to represent the commercial department of a central station. Heretofore there has been little opportunity for study of central-station practice by actual service with an operating company combined with class instruction.

The new Institute is located at 112 West Adams Street, Chicago, next door to the office building of the Commonwealth Edison Company. The officers of the Institute are E. W. Lloyd, president; Charles A. Munroe, vice-president; Fred R. Jenkins, secretary; William A. Fox, treasurer; J. H. Gulick, auditor. The Board of Directors, in addition to the president and vice-president, includes Frank J. Baker, John F. Gilchrist and Martin J. Insull.

Power Contract for the Reclamation Service.

A contract has just been executed between the Department of the Interior and the Great Falls Power Company of Montana for electrical energy for use in connection with the construction of the Sun River irrigation project. The contract calls for 2,500 kilowatts throughout a period of six years.

The company will transmit the power 100 miles and deliver it to the Reclamation Service at a number of substations from which it will be distributed to the work.

Proposals for excavating the main canal which will be 45 miles long, will be advertised for immediately. The diversion dam, 140 feet high, and the diversion tunnel, will be constructed by Government forces.

The use of electrical energy for the excavating work of canals is not only a new departure, but marks an epoch in construction work, and a reduction of cost and time will doubtless be accomplished.

There are already twelve towns within the limits of the project, and as many more have been projected. The electrical energy which will be available when the land is open to entry will be of great advantage in that each of the towns will have cheap light and power for manufacturing and allied uses.

Alternative Rate Offered in Pittsburgh.

The Duquesne Electric Light Company of Pittsburgh, Pa., has announced a two-charge rate for consumers who prefer to make a new contract on that basis. The flat rate is determined by a charge of 15 cents for each first-floor room and hall in residences, rooms on upper floors being charged at the rate of five cents each, excluding bathroom and hall. In apartment houses all floors are considered as first floors. The minimum charge is 65 cents, and in buildings where there are more than 50 sockets there is a charge of two cents per socket for all over this number. In addition to the fixed charge, current is charged for at the rate of six cents per kilowatt-hour, with a reduction of one cent for prompt payment. The previous rate was 12 cents per kilowatt-hour with a two-cent discount.

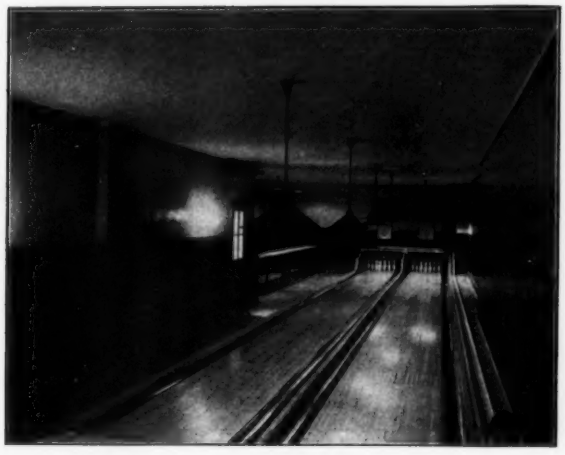
Club House of New York Edison Employees.

The new club house of the Association of Employees of The New York Edison Company, views of which are shown herewith, is located at 113 East Twelfth Street. It is in every respect as near the ideal of what a club house should be as will be found in any part of the country. It was opened with fitting ceremony on February 4 and officially presented by The New York Edison Company to the Association of Employees.

Music Room.

Smoking Room.

Billiard Room.



Bowling Alley.

The building, which is a five-story structure, is the property of the company, which will bear all of the running expenses. The entire equipment and furniture of the new club house were also supplied by the company. On the ground floor, besides a charming little reception room, are the bowling alleys and shuffleboard. Bowling has long been the chief pastime of the employees of The New York Edison Company; now they will have an opportunity of bowling on perfect alleys in their own home. On the second floor is a large reception room suitable for dances or entertainments, while off of this is the music room. The furniture in these rooms is made of leather and mahogany. The floors throughout the house are hard maple, highly polished. The athletics and bowling trophies won by various teams of the company are exhibited in the large reception room on the second floor. The third and fourth floors are pool and billiard rooms, equipped with every modern accessory, while the fifth floor is the library. The library is finished in bird's-eye maple and contains more than 1,000 volumes. On one of the tables is the first electric fan modeled by Thomas A. Edison, while a life-sized portrait of Mr. Edison adorns the wall. Off from the library are several little nooks suitable for quiet reading.

The Woman's Auxiliary Association will meet in the club house each week and on all other occasions that it desires to use the building.

William T. Dempsey is the present president of the Association of Employees, which numbers nearly 3,000 members. This new club house typifies the splendid spirit which exists between employer and employee in The New York Edison Company.

Power for the Panama Exposition.

A contract was signed on March 5 between the Panama-Pacific International Exposition Company and the Pacific Gas & Electric Company under the terms of which the latter will supply all electric power required during the construction, operating and dismantling of the World's Fair in San Francisco in 1915. An estimate of the requirements is 20,000 horsepower, and the total value of energy consumed is placed at $500,000. The same company will supply the gas and steam required in the exposition grounds.

A company has been organized in Rio de Janeiro, Brazil, for the purpose of utilizing the Paulo Alfonso Falls of the San Francisco River to generate electric power.

Electrical Construction

THE ELECTRICAL EQUIPMENT IN A LARGE MACHINE SHOP.

Notes on Apparatus and Methods of Installation.

In order that the greatest gain which the adoption of electric drive in an industrial plant makes possible may be realized it is usually necessary that good judgment be exercised in the selection of apparatus and that this be installed in accordance with plans carefully drawn after operating conditions have been given thorough consideration. In the plant of the David Bradley Manufacturing company these requirements were met much more fully than is usually the case in establishments of this character, it seems. This plant, which is located at Bradley, Ill., and is the property of the big Chicago mail-order house of Sears, Roebuck & Company, manufactures farm implements. A good idea as to the size of the business may be obtained from the amount of power for which transformers are supplied. Notes concerning the transformer capacity and the methods of installing and connecting the transformers are included in the following paragraphs. The buildings cover approximately 40 acres of ground space.

Until about two years ago this factory generated its own power. In the parts of the plant most remote from the engine room induction-motor drive was employed, current being supplied from an alternator driven by one of the company's steam engines. Nearer the engines which formed a part of the factory equipment apparatus was operated from long lines of shafting. All lighting was done with direct-current generated in the shop. Two years ago or so, however, the company discontinued the use of steam drive altogether and connected the entire load to the lines of the Public Service Company of Northern Illinois. Induction motors are used now throughout the plant and alternating current is also employed for lighting.

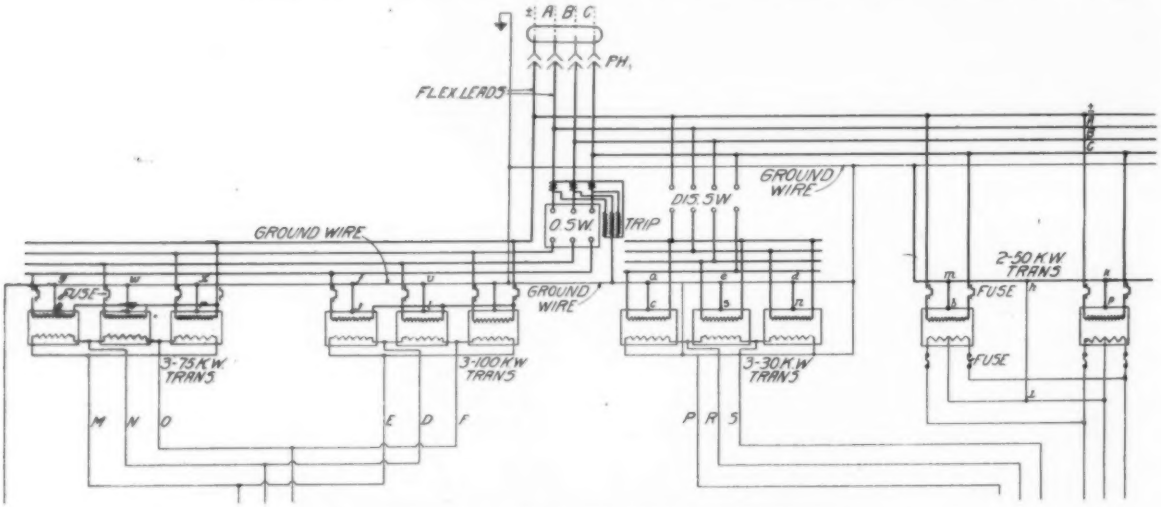


Fig. 1.—Diagram of Service and Transformer Connections.

Service Connections and Transformer Installation.

It is common practice on the lines of the Public Service Company of Northern Illinois, which supplies electric power to a large part of the northeastern portion of the state, to employ four-wire three-phase circuits for the transmission and distribution of energy, and a usual pressure is 2,300 volts between the neutral and either phase wire, or 4,000 volts between any two phase wires. Thus the saving in copper of a 4,000-volt line is obtained while it is only necessary to employ 2,300-volt transformers. Moreover, this sort of distribution is said to simplify the matter of using voltage regulators on each phase, and it takes care of troubles that might arise from an unbalancing of the load among the phases where three-wire three-phase lines were employed. In branching off from a transmission line to supply single-phase power for lighting a village or small town near by, the neutral and a phase wire are tapped, and when one single-phase transformer is to be cut into circuit the connections are similarly made. To connect a bank of three single-phase transformers the primaries are joined in star, the neutral point being connected to the neutral wire of the primary circuit, and then each one of the three free terminals of the primaries of the group of transformers is connected to a separate phase wire of the supply line. The secondaries may be connected in either star or delta, of course. How these are connected is generally determined by the ratio of voltage transformation desired.

Fig. 1 is a diagram of the connections of the transformers in the David Bradley plant. There are eleven of these units, consisting of a bank of three General Electric 100-kilowatt transformers, a group of three Westinghouse 75-kilowatt transformers, a group of three Westinghouse 30-kilowatt transformers, and two 50-kilowatt units employed for lighting. All transformers are wound for 2,200 volts primary and 110 or 220 volts secondary, the higher of the two secondary pressures being obtained by connecting the two halves of the sec-

ondary windings in series, which connection is adopted on the secondaries of all but the lighting transformers. As is shown in the diagram referred to, the secondaries of each bank of three transformers are joined in delta.

Fig. 2.—Corner of Transformer Room.

The pressure between the neutral conductor and any phase wire of the four-wire three-phase service being 2,300 volts, it is seen from the foregoing remarks and from an inspection of Fig. 1 that the secondary pressure on the power circuits, at the transformers, is slightly over 220 volts between any two of the three wires of any circuit. The pressure here minus the voltage drop in feeders and mains leaves a pressure which is very close to 220 volts at the terminals of each motor, and 220 is the voltage rating of most of the motors.

Beginning at the left side of Fig. 1, the first six transformers are used to supply ordinary shop power. Their secondaries ar connected permanently in multiple. The third bank from the left consists of three 30-kilowatt transformers used to drive a 100-horsepower fire-pump motor. The two units in the right side of the diagram supply current to the three-wire single-phase incandescent lamp circuits used in lighting the shops and offices. It will be noted that these lighting transformers are connected in multiple on both the high-voltage and the low-voltage sides. This arrangement gives about 115 volts pressure between the middle and either outside wire on the lamp circuits.

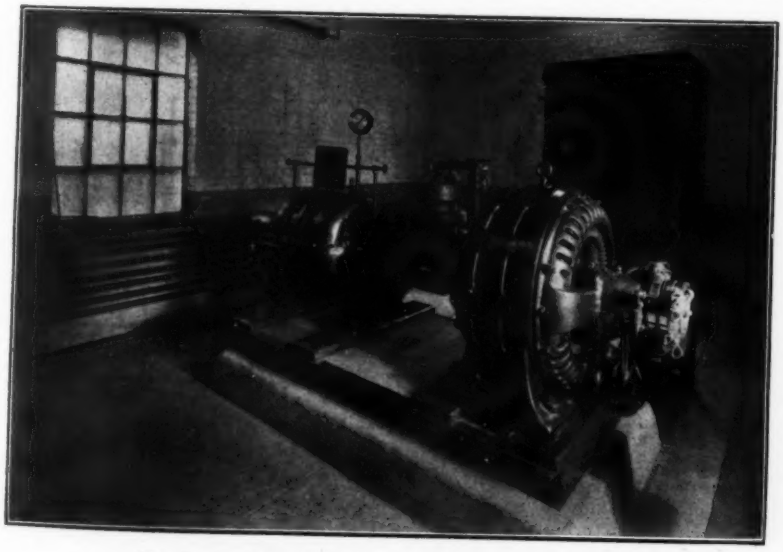


Fig. 3.—Slip-Ring Induction Motor Driving Fire Pump.

The 2,300 to 4,000-volt service is brought into the transformer room of the factory in question through four G. & W. disconnecting potheads (*P H* in Fig. 1). The cables to the primary sides of the main power transformers are carried through the oil switch *OSW*, this being an automatic switch which is opened on excessive current, by the action of the trip coils shown in circuit with the three current transformers connected just above the switch. On the primary side of the lighting transformers there is no switch at all, and that in the primary lines of the transformers for the fire pump is not automatic.

The cases of all the transformers are grounded; and likewise the secondaries of the transformers. The grounding of the secondaries of the six transformers in the left side of Fig. 1 is done at the main switchboard, this board being installed in the transformer room. The short conductors marked *a-c*, *c-s*, etc near the center of Fig. 1, are ground wires for the cases of transformers. All such wires are No. 4 B. & S. rubber-covered conductors, while for the main ground wire a No. 0 rubber-covered wire is made use of.

Fig. 2 is a photograph of a corner of the transformer room. This room, having a cement floor, brick walls, cement ceiling and fireproof windows and door, is believed to be thoroughly fireproof. The primary wiring from the service to the transformers is done with 5,000-volt rubber-covered cables supported on angle-iron framework in such a way as to make an unusually substantial and neat looking piece of construction. Wherever a cable is attached to the iron a maple bushing is slipped over it first and then a No. 5 Minerallac clip is employed to hold the cable permently in place. From the low-tension sides of the transformers to the switchboard double-braided rubber-covered cables are run in vitrified tile ducts laid in the cement floor. For pulling the cables into the floor, floor-boxes with slate covers were provided.

Motor Installation.

The problem of laying out the motor drive for such a large plant having so great a variety of machinery was a difficult task. This work was put in charge of the company's mechanical engineer, Theodore Wachs. In changing from steam to electric drive time did not permit them to rearrange the machinery on the floor for the most

economical method of drive. The main line-shaft was divided into several sections and each section belted to a motor suspended from the ceiling. These motors ranged in size from 10 to 30 horsepower, as 30 horsepower was considered the maximum size for economical group drive. Later these machines were rearranged for more economical drive, some of them being provided with individual motors.

Three-phase, 220-volt induction motors are used throughout the factory. All squirrel-cage motors above seven horsepower are provided with starting compensators, and the large sizes with no-voltage release for protection in case voltage goes off the line long enough to stop the motor and comes on again before an attendant has time to throw the starter handles in the "off" position.

The drive in the tool shop is confined to individual drive on machines not used much and on special machinery, and group drive on machines used continually or frequently, such as lathes,

Fig. 4.—Induction Motor Driving Planer.

shapers, small planers, drill presses, etc. Fig. 4 shows a 10-horsepower Triumph motor driving a large planer in the machine shop.

Where group drive is employed the motors are usually mounted on the ceiling. While this construction has not eliminated the use of belting and shafts as nearly as might be desired, it has resulted in great gains in efficiency of operation.

Two especially interesting examples of group drive are found in the pump rooms shown in Figs. 3 and 6. Fig. 3 is the 100-horsepower motor and fire-pump installation already referred to. The motor, which was built by the Triumph Electric Manufacturing Company, is of the three-phase slip-ring type, as is also the 15 horsepower Triumph machine shown in Fig. 6. Because of the exacting nature of fire-pump service the motor for the pump shown had to be of a most thorough design and construction. A machine of this sort must always be one that will start its load promptly under all circumstances and keep it going during an indeterminate period without excessive heating or the development of other troubles. Although the motor shown in Fig. 3 may be shifted to the circuits of the main power transformers in the factory, there is no switch or other circuit-opening device in the circuit on which the machine normally operates, between the transformers and the motor-starting panel. This starting panel is one supplied by the Cutler-Hammer Manufacturing Company, and the circuits on it are shown in Fig. 5. To start the pump the main circuit-breaker and switch are closed first, which throws the line voltage on the stator or primary winding of the motor. The starting resistance is then gradually cut out of the secondary or rotor circuit by closing, one at a time, the hand-operated switches one of which is marked *mrn* in Fig. 5. The left-hand switch is closed first, and the design of the starting device is such that a second switch cannot be closed until the preceding one is closed completely. This arrangement makes it certain that the successive resistance steps will always be cut out in the proper time sequence. Closing the left-hand switch closes the circuit between *m* and *n*, and *m* and *r* and thus short-circuits the first section of the starting resistance; similarly for the other switches and resistance sections, it being understood, of course, that the leads *A B C* in Fig. 5 are connected to brushes resting on slip rings mounted on the rotor shaft.

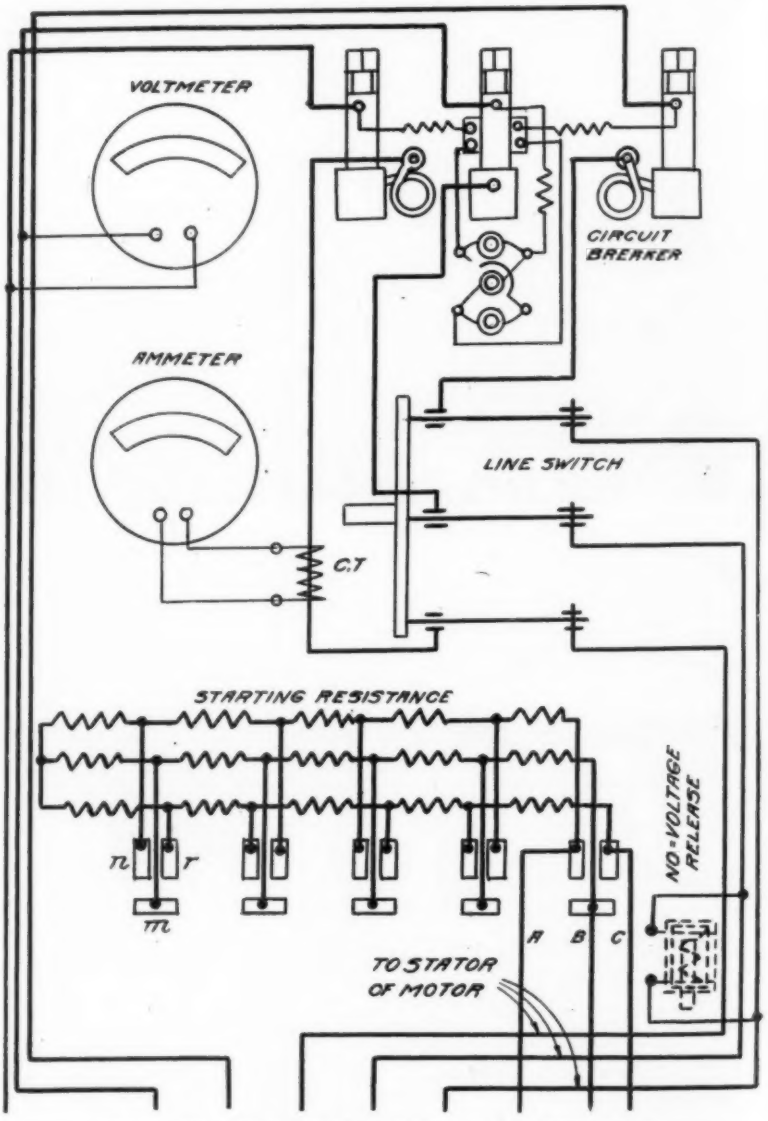


Fig. 5.—Diagram of Circuits on Starter of Fire-Pump Motor.

The no-voltage release shown opens the circuit-breaker, and, at the same time, cuts the starting resistance back

into the secondary circuit in case the live voltage fails.

The motor shown in Fig. 6 is started and stopped automatically by means of the Cutler-Hammer starting panel and pressure switch installed with it.

Wiring.

The wiring for power and lighting circuits in the Bradley factory is at present nearly all knob and cleat work, except where the wires are exposed to mechanical injury or dampness; here they are in conduit. Separate circuits for power are run from the distributing board to the various departments. The motors in the forge and polishing rooms, which aggregate 300-horse-power, are supplied by a circuit of 1,-

Fig. 6.—Three-Phase Slip-Ring Induction Motor with Automatic Starting Device.

250,000-circular-mil stranded cable, rubber covered. In other departments the circuits are run on the ceiling through the room, as near the "center of gravity" as possible, and branch mains taken off through fuse and switch to the separate motors. In the woodworking shop the wires are in conduit.

The wiring in the foundry and forge room is of triple-braid slow-burning wire, which does not deteriorate by the continued high temperatures which are found in these departments.

Three-wire service is carried to all departments for lighting purposes and each department has its own mains running from the transformer house through the center of the room. The block system of lighting is used in most of the departments with individual carbon lamps for detail work where they are required. In the forge, polishing and shipping rooms five-light clusters with enameled reflectors are in use for general illumination. Where the block system is used the lights are placed in squares 20 feet apart. Branch circuits are taken off the mains running through the room and carried to a distributing panel located on the side walls, within reach from the floor. Each panel controls 36 lights, by six circuits of six lights each controlled by snap switches and protected by fuses in the panel box. The panel boxes are all made of iron and conduit is used to carry the wires from the ceiling to the box, which gives the wires ample protection from mechanical injury. The circuits for detail lamps are separate branch circuits and controlled by sockets at the lamp. Carbon and tungsten lamps are used for general illumination throughout the buildings.

Contractors and the Science of Illumination.

How many contractors have studied the question of scientific illumination or are in a position to give advice as to the most efficient and suitable system of lighting to be adopted by a customer whose premises they are wiring? The contractor should be the man to whom the user should look with confidence for assistance when planning an installation. Few consumers know anything about the laws of illumination, and without intelligent guidance they are apt to allow a lighting scheme to be installed which can never give satisfaction, except perhaps at excessive cost. In wiring a private residence, considerations of comfort and absence of eye strain receive far less attention than the saving of a few shillings in wiring costs, yet a lighting scheme which will be satisfactory in all respects need not cost anything more than one which transgresses every rule of scientific illumination. It is more a question of the position and height of lamps and the type of reflector or shade employed than of the number of points installed. Costly fittings may be just as unsuitable for their purpose as the cheapest pendant, while a little thought and intelligence may secure for no greater outlay a system of lighting which will be scientifically correct.

There is ample room for missionary work on the part of contractors among shopkeepers, who are the most obvious sinners against scientific principles of illumination. It may not always be easy to convince a private householder that the position and type of fittings he proposes to employ are unsuitable, but the shopkeeper should be more amenable to argument, since the success of his business in most cases depends upon the attractiveness of the display in his showroom and window. A walk through the main business streets of any large town will convince anyone that few traders know anything at all about the science of illumination. There may be ample light—often there is far too much—but the lamps are placed incorrectly, and merely cause glare without achieving the object for which they exist—viz., to throw a good light upon the goods displayed. Many shopkeepers imagine that they attract custom by suspending flame-arcs as close as they can be squeezed together along the frontage of the shop within seven or eight feet of the pavement. They only succeed in half-blinding pedestrians and preventing many from seeing even what trade is being carried on. Others crowd the front of the window inside with strings of naked lamps, the glare from which effectually prevents passers-by from seeing the goods behind them, as a rule, except with considerable discomfort.

Jewelers are extremely fond of this system of shop-window and show-case lighting, forgetting that reflection from gold and silver objects is a factor to be guarded against rather than aggravated by the presence of unprotected points of light all over the window. It is not light that is wanted so much as adequate and correct illumination of the objects offered for sale, and the value of a shop window to attract business may be increased enormously by a carefully thought out lighting system for the hours of darkness.—*The Electrical Times.*

A Live Furnace.

The peculiar action of a ground and the instability of fire brick as a ground was called to the attention of the writer a short time ago, when a man who was operating an oil heated galvanizing furnace complained that whenever he took hold of the dipping basket which set on top of the brick furnace he received a shock.

The furnace is built of fire brick on a concrete floor, which is about four inches thick. It is the regular square type of galvanizing furnace, capped with a cast-iron plate with a hole in which sets the kettle. The smoke stack for carrying off the fuel-oil smoke and the hood which carries off the fumes are all connected together. Investigation showed that a guy holding the hood had broken and fallen against the terminal of a rosette from which the current passed to the kettle. This ground, as one may call it, did not show up on the switchboard ground detector at all, but the "live kettle" worried the galvanizer dreadfully. A. P. Broadhead.

Putting On a Heavy Belt.

To put a heavy tight closed belt on a wide pulley, make use of the device shown in the sketch. It is made of machine steel, two inches and three inches wide and five-eighths or three-fourths of an

Device for Putting Belt On.

inch thick, and is twice as long as the pulley is wide. Being clamped on the pulley, the belt is slipped over the bent arm A, and the pulley turned by hand and the belt pushed into place.

Robert Grimshaw.

Baltimore Contractors Advertise.

The Blumenthal-Kahn Electric Company, of Baltimore, Md., which signs itself "The Live Wire Contractors," is conducting a newspaper-advertising campaign which is attracting wide attention. The advertisements are being run in the Baltimore dailies, and they are clever and forceful. For example, one which appeared just before the recent presidential inauguration, stated that the company's "inaugural message" was a recommendation that houses not already wired for electric lights should be wired without delay, and gave a number of very excellent, well stated reasons why this wiring should be done. The "message" concluded with a summary of the company's claims to consideration when contracts for any sort of electric wiring are to be let. It is said that this advertising is bringing splendid results.

How the Trouble with the Induction Motor was Overcome.

I have just come across a case of induction-motor trouble that is new to me, and I have been unable to find anything in the books or journals that even gives an excuse for it. It concerns a 30-cycle, 440-volt, three-phase motor, of 50 horsepower rating.

The motor refused to pick up a speed of more than 80 or 100 revolutions a minute, although it was supposed to run at 900. The motor starter was changed, but this did no good, and then a change in the connections proved equally ineffective. Finally a man was called in from the factory where the machine was built. Having restored the connections to their initial condition without bringing about any change in the speed, he made some remark or other about subsynchronous speed, and announced that the rotor needed turning down in a lathe so as to reduce its over-all diameter slightly. He said that either the air gap was so small that the stator windings were too nearly surrounded with iron or else the iron of the rotor core projected so far above the rotor bars that the magnetic flux did not pass around the bars so as to cut them. He was not very sure what the correct explanation was.

He took the rotor to a machine shop and turned 0.017 inch from its diameter. Then when the machine was assembled again it came up to the rated speed promptly.

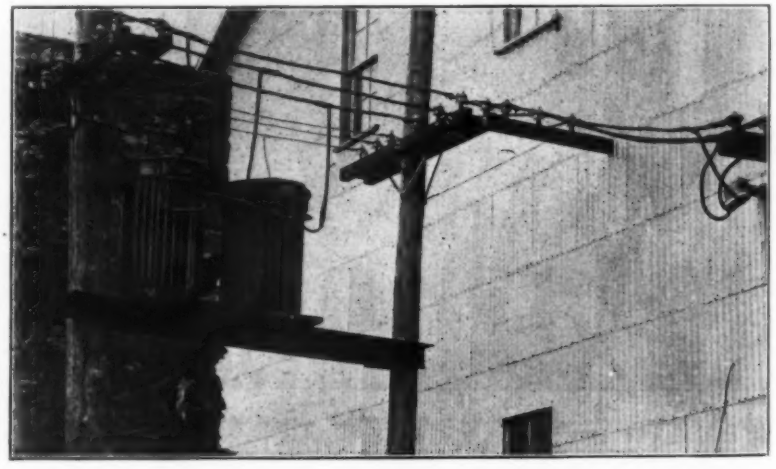
This seems to contradict the usually accepted (I believe) statement that the air gap is to be made just enough for mechanical clearance, and that the smaller the gap the greater the efficiency in most ways. I have not seen anything of this kind in print, and it seems to be new to others who are fairly well informed. The factory man stated it was something that appeared only in 25 or 30-cycle motors. C. W. Goddard.

INSTALLING LARGE POLE-TYPE TRANSFORMERS.

By O. P. Sammons.

Not long ago the writer was called upon to take charge of the installation of two transformers for supplying three-phase power to the plant of a mill and grain company. Each unit was a pole-type, single-phase transformer designed for a load of 50 kilovolt-amperes, with a pressure of 220 volts between any two of the three mains of the secondary circuit. It was not considered practicable to hang both these transformers on the terminal pole at the mill and grain plant, and hence the construction shown below was adopted.

The character of the work is so well shown in the figure that but little is necessary in the way of description. A stub pole was planted near the terminal pole, and pieces of angle-iron run from one pole to the other as shown. The two transformers were then set on boards laid across these irons, the height of the platform from the ground being 12 feet.



Transformers in Place with Connections All Made.

Both poles were double cross-armed just above the transformers, and the primary wires run on one side of the poles and the secondaries on the other, the primary fuses being attached to one set of arms. The transformers were connected in open delta, as is customary when two transformers are used to step three-phase voltage up or down, and the secondary wires were carried into the building in a pipe terminating in a condulet fitting at the outer end.

The production of copper in Idaho in 1912 showed an increase of 46 per cent over the previous year, it is stated.

Among the Contractors.

The Greene & Russell Electric Company, of Atlanta, Ga., has moved from 19 Peters Street into more centrally located quarters at 8 West Alabama Street.

F. L. Decker, of Chicago, has secured the contract for wiring a large apartment building on South Park Avenue in this city. Circuits are to be installed for nearly 600 incandescent lamps.

The H. E. Lowe Electric Company, of Macon, Ga., did the work of installing all conduit and connecting up the generators, etc., in the plant of the Georgia Public Service Corporation, the new lighting company of Macon. This company is also installing the electrical equipment in the new Waycross, Ga., post office.

Edward J. Durtnall, electrical contractor, whose headquarters were formerly at 380 Park Avenue, New York, has moved into larger quarters at 10 East Forty-second Street, the change of location having been made necessary by recent increases in business.

Contracts for wiring the City Hospital in Springfield, O., and a new warehouse building for Swift & Company, in the same city, have been awarded to the Hawkins Electric Company, of Springfield.

Percy E. Wood has just bought the interest of his partner in the electrical contracting business of Wood and Van Orsdal, in Chattanooga, Tenn., and the business will be conducted under his own name at 8 West Sixth Street. Mr. Wood has had a great deal of experience in armature winding and repair work, and will specialize in this class of work.

The Erner & Hopkins Company, of Columbus, O., has purchased the Globe Electrical Company, one of the largest electrical supply houses in Dayton, O., and will call it the Dayton Branch of the Erner & Hopkins Company. D. B. Howland, formerly with the General Electric Company, is manager, and F. K. Bybee, for many years salesman for the Erner & Hopkins Company, will be assistant manager. The company is doing a nice business in Dayton, and looks forward to a large increase within the next few years. Dayton is one of the thriving towns in Ohio.

The electrical work in the Otis & Swanson apartment building, in Chicago, is being done by R. C. Bierdeman, of this city. There will be 1,200 incandescent lamps in this building and about 100 horsepower in motors. The electrical work is now nearly completed.

E. R. Dickerson and C. E. Slawson have commenced business under the firm name of Dickerson & Slawson, and about March 15 will occupy the store at 314 Broadway, Waukesha, Wis. The firm does general electrical contracting and is already in the field and prepared to take orders.

A contract for the installation of new conduit wiring and a number of lamps in the remodeling of the Warren Courthouse, of Bowling Green, Ky., has been awarded to W. H. Isbell.

Terrell-Hedges Company, of Chattanooga, is installing, complete, the white way on Market Street, the principal thoroughfare of that city. There will be 12 standards to the block and they will extend a distance of somewhat over a mile. It is expected to have this work completed by the time of the Confederate Veterans' Reunion, which will be held in Chatanooga in May.

General equipment in the Burnett Avenue buildings of the City Hospital in Cincinnati, O., has been contracted for by the Hospital Commission of that city. The William Carrao Electric Company, of St. Louis, Mo., will supply the electric feeders in the hospital wings, and lighting fixtures, wiring, etc., are to be supplied by the W. G. Reuter Company, of Cincinnati.

Beltzhoover & Company, leading electrical contractors of Cincinnati, O., recently secured a contract for an extensive wiring job in the handsome new residence of William Doepke.

The Walker Electric and Plumbing Company, of Rome, Ga., is putting in the complete electrical installation in the Bonita Theater, in Gadsden, Ala. The company makes a specialty of motor installation and is installing in Columbus, Ga., through its Columbus branch, the motors and lighting system of the Meritas Cotton Mills, an installation of 325 horsepower in motors in the Dudley Lumber Mills, and an installation of motors in the plant of the Berry Brick Works.

Among the large installations of electrical work which the Electric Construction & Machinery Company, of Rock Island, Ill., is just now completing are an electrically driven filter plant, in Rock Island; equipment for electric drive and haulage for the Albion Shale & Brick Company, Albion, Ill., and the Dawson Brick & Tile Company, Springfield, Ill.; and complete electrical installations for the O'Gara Coal Company's Jefferson and Citizens' Mines. The filter-plant pumping installation has a capacity of 3,000,000 gallons per day, and the work on it included a complete new substation, switchboard, etc. The jobs at the mines mentioned consisted of the erection of direct-connected electric hoists, shaker screens, electric pumps, haulage systems, car pullers, etc. The mine work was handled through the Company's Springfield office, which is known as the Ecco Engineering Company. Two other important jobs which the Electric Construction & Machinery Company has on hand now are the wiring of the Young Men's Christian Association building in Rock Island, and the electrical work in the plant of the Barnard & Leas Manufacturing Company, at Moline, Ill. The installation last mentioned includes the equipment of a modern type of substation, and the putting in of 500 to 600 horsepower in motors, together with the circuits for these and about 100 kilowatts in lighting.

E. T. Grunwald, for the past eight years an electrical inspector in the employ of the Louisville & Nashville Railroad Company, of Louisville, Ky., has become secretary-treasurer of the Marine Electric Company, one of the leading contracting concerns of that city. E. L. Stirlwell is president of the Marine company, and with the addition of Mr. Grunwald the concern will take steps immediately toward a bigger and better business. A contract was recently secured by this company for wiring and a complete motor installation in the new addition to the bottling room of Oertel's Brewery on Story Avenue, in Louisville. The most important Marine contract is one for wiring, throughout, the new million-dollar power station of the Louisville Railway Company, which is being erected at Twenty-first and High Streets.

NePage, McKenney & Company, electrical contractors, of Seattle, Wash., successors to the Empire Construction Company, has secured the contract for the following electrical work: the 42-story L. C. Smith Building, which entails the installation of 18:5 miles of electrical conduit, weighing 120,000 pounds, and 60 miles of lighting, power, telephone and telegraph wires, representing the expenditure of approximately $32,000; the Multnomah Library, Portland, Ore., $12,000; the four-story Cohen Building, Portland, Ore., $8,000; the 10-story Multnomah Securities Company Building, $10,000; and the Yorkshire Guaranty Building, Vancouver, B. C., $10,000. They are all contracts which have recently been awarded.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, president, 59 Deerfield Street, Hartford, Conn.
JAMES BENNETT, vice-president, 524 Coristine Building, Montreal, P. Q.
WILLIAM LINCOLN SMITH, secretary and treasurer, Concord, Mass.
JAMES E. COLE, National Conference Representative, 11 Wareham Street, Boston, Mass.

Executive Committee:

H. S. WYNKOOP, chairman, 13 Park Row, New York, N. Y.

Frank R. Daniel, R. P. Strong, Henry E. Knight, Washington Devereux, James B. McCarthy, W. Lincoln Smith, James Bennett, C. W. Mitchell, George L. Collison, T. H. Fritts, James S. Meade, T. Henry Day, James E. Cole, Thomas D. McColl

Secretary's Message.

Thomas W. Bowry, municipal electrical inspector, Richmond, Va., and H. W. Greenlaw, city electrician of Beverly, Mass., have been elected members of the Association.

The tenth convention of the Association will be held in the Edison Auditorium, 44 West Twenty-seventh Street, New York, on Tuesday, March 25, and will be called to order at 11 a. m. The brief morning session will be given to routine business and the election of officers, and the remainder of the day, after lunch, to the discussion of the proposed changes in the Code and determining what position (if any) the Association wishes to assume officially upon the several proposals. In the evening an informal dinner will be held at the Hotel Flanders, this being the tenth anniversary of the organization of the Association. The dinner will be arranged under the direction of a committee of which Hugh T. Wreaks, 80 Maiden Lane, New York, is the chairman. The price will be $2.00 per plate. Members who expect to attend and who have not already made this known to me will please notify me as promptly as possible, because the arrangements will be largely determined by early information as to the number to be expected.

On Wednesday and Thursday, March 26 and 27, the time will be taken up with the general meeting of the Electrical Committee, at the rooms of the New York Board of Fire Underwriters, 123 William Street, which all members are urged and expected to attend. The sessions begin at 10 a. m.

Detailed information as to the dinner and other matters will be mailed to members as promptly as possible. It should of course be understood that members may invite others to the dinner as their guests, but information of this intention should be given to Mr. Wreaks as early as possible.

I give here a set of answers to Questions 216 to 220, inclusive, which answers have just come to hand. Receipt of these was delayed by the absence of the member submitting them from his place of business.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Question 216.

Answer 9 (D). Where wires pass through the walls in gang boxes, short lengths of flexible tubing should be used for protection.

Question 217.

Answer 9 (D). There is no rule in the Code which requires that plug and cartridge fuses shall be inclosed in cabinets under all conditions. Specific conditions are mentioned where cabinet protection is required.

Question 218.

Answer 9 (D). Bridging of the two outside wires upon three-wire services should not be permitted where the service supplies more than 660 watts. It has been found more practical and satisfactory to require the use of two-wire circuits, in residence sections in particular, and balance one service against the other on the outside secondary circuit.

Question 219.

Answer 10 (D). We do not believe the practice of concealing service conduit within a lath and plaster partition is good or safe construction, even though the conduit is grounded. In the event of break-down in transformer winding, it would necessarily introduce primary voltage over secondary lines, which would be liable to cause undesirable results in combustible partitions. Where the conduit is run in channels in brick or concrete walls, we would consider it good construction.

Question 220.

Answer 10 (D). The use of porcelain cleats attached directly to steel ceilings should not be permitted. A small wooden block should be first attached to ceiling and the porcelain cleat attached to block.

In regard to the questions which appear in this issue, only one, Question 221, seems to require comment; but this is certainly some question. A perusal of the replies received will show the widely different opinions expressed. The matters seemed so interesting to the Secretary that he wrote for further information, and received the following: "The installation that gave rise to this question is all contained within the building. The cables run from the main switchboard in the transformer room under the floor to a distributing board in the meter room 175 feet distant. The primary service is 60-cycle, three-phase, Y-connected, 4,000 volts per phase, center grounded. Secondary is 220 volts, three-phase."

It would seem to the Secretary that although the Code has a brief reference to the matter in Rule 2*a* and the list of approved fittings approves fiber duct for use in central stations, yet this has to be modified a little, as precisely the same reason for use might arise in a substation, which is not technically a central station. And in this case he does not see why it should not be used, especially as one could hardly put a single cable in an iron pipe and could not put all three in one pipe

without a lead sheath about each, which is out of the question; otherwise all three conductors would have to be made up into one cable under one sheath, which would make a thing so rigid as to almost have to be poked in like a long bar.

At first blush it might seem that the lead should go on; yet, as a matter of fact, the case is out of the ordinary and certain effects appear which are ordinarily either negligible or nonexistent.

The use of the lead sheath is perhaps more of an engineering question. Nevertheless, two inspectors say moisture would decide the matter, while two say lead should be used anyway. It would seem worth while to examine briefly just what will happen, though it must be confessed it is not an easy question, for many reasons. The Secretary would further say that after working out the matter in his own mind he talked it over with Professor Clifford, of Harvard, and with one or two other local engineers.

In order to arrive at a clear conception of the case it may be well to state the characteristics of the cable. The diagram shows a full-size cross-section.

Diameter of 2,000,000 circular mil cable, 127 strands (Roebling), 1.632 inches.

Thickness of rubber braid and tape over rubber, 0.243 inch.

Lead thickness, 0.141 inch.

Over-all diameter of lead-sheath cable, 2.40 inches.

Resistance of cable, allowing for the twist of stranding and for skin effect, which though small is still appreciable, 0.00103 ohm per 175 feet.

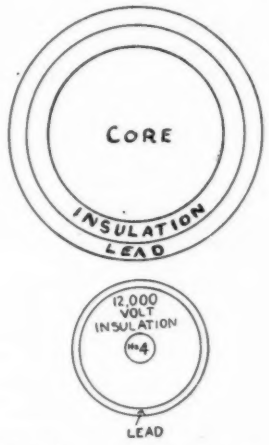
Inductive reactance of 175-foot cable in equivalent ohms, 0.0165.

Resistance of 175 feet of lead sheath, 0.0176 ohm.

Now let us assume the sheath to be present. It is of course a fact that it will increase the capacity reactance of the cable, and hence so far as this goes will tend to counteract the inductive reactance; but on account of the low voltage the effect is not very pronounced. Taking the current flowing in the cable at the allowable capacity, we get 1,050 amperes. It may be said that it is not likely that the cable will be loaded to this amount, but even if the motors are running light the consequent reduced power-factor will lift the current above what is required; so the assumption is perfectly fair.

Combining the resistance and reactance of the cable we get an impedance of 0.0167 ohm, which, with the above current, will give us a voltage drop in the conductor of 17.53 volts.

Now consider the variation of the magnetic field about the conductor. Bearing in mind that the center of our lead sheath is only 0.313 inch away from its surface and that it is a relatively large core with a heavy current, it will be found that the conditions of the field cannot be determined by the usual formulas and that the mathematics required are extremely intricate. The gradient of the field is very steep, however, and the resulting effects are three. First, the lead sheath acts like the secondary of a transformer of which the core is the primary, and, since they are relatively so near, in almost a 1:1 ratio—not quite, but so that about 16 volts will be set up in the 175-foot length. Suppose the sheaths of two cables are allowed to touch at the ends; then there is an pressure of almost 28 volts (two star-connected pressures of 16 volts each) acting in a circuit of two lengths of the lead sheath, or 0.0352 ohms; and



Relative Sizes of Cables with 2,000,000-Circular-Mil Conductor and No. 4 Conductor.

this means a current in the sheath of nearly 800 amperes. Again, suppose one lead sheath is grounded at the ends; then we have 16 volts acting in 0.0176 ohm plus the ground return, a maximum possible current of about 80 amperes.

While the inductance, impedance, etc., are calculated for only a single cable in the above computations, the inductance, etc., between individual members of the three-phase group could easily be determined by means of ratios that are well known. It should be explained that several of the above quantities are given in round numbers; the current strength stated as 800 amperes, for example, might be anywhere between 750 and 850 amperes, according to circumstances.

Second, the thickness of the lead sheath and the steep gradient of the field mean that the induced voltage is widely different between the inner and outer surfaces of the sheath, and in consequence heavy eddy currents will circulate in the sheath, heating it and making trouble.

The third result is that the effect of the secondary current flowing in the sheath would tend to reduce the impedance of the cable so that the voltage drop would fall and the current also until the effects balanced somewhere in between.

The Secretary has been informed by two engineers of large companies that it has been found impossible to keep the lead on a cable like this in a number of cases where these effects were at the root of the trouble. Also, in some tests carried out on a large cable in a factory near Boston, by Professor Clifford, the lead sheath on one cable grounded at each end to a water pipe (I believe) through an ammeter showed a transformer action with voltages that checked the above reasoning and a current flowing of 60 to 65 amperes, while the presence of eddy currents was clearly marked.

It is pretty nearly impossible to tell whether the impedance of the circuit as a whole would be modified by the lead or not; but it would seem that the effect would not be large, but such as it is, it would be a tendency to improve conditions—could it only be kept on.

The case is differentiated from the ordinary; for instance, in the primary of this construction. Here we have 4,000-volt lines and consequently a current of only about 60 amperes, which means, of course, a small core, much greater thickness of insulation, and less lead; in fact, a No. 4 wire (0.205 inch in diameter), nearly 0.5 inch thickness of covering, and then only 0.0625 inch of lead. Under these conditions the resistance of the lead sheath is high, the eddy currents negligible, and the distance between the core and sheath such that with the weak field the transformer action is nil. At the same time, there comes the condenser charging current due to the high voltage. But the two cases are absolutely different.

As one of the engineers with whom the Secretary talked suggested, it makes some difference whether this 175 feet is the end of a long cable coming in through ducts from outside or whether it is a unit in itself as in this case. Again, although it is two inches below the floor it is not to be considered as outside the building, and all agreed that fiber ducts would be all right, that they would not use lead, but a heavily jute-protected cable instead, and that the more moisture there was in the duct the worse the lead would be, since there would be short sections connected through varying ground resistances; and though the induced electromotive force in these

sections is small the resistance of the section of sheath falls proportionately. Thus there would practically be a lot of low-voltage, low-resistance secondaries operating on circuits of varying resistance, from very high resistance to almost nothing; and first, the heat in the copper core; added to this the eddy-current heating; then the heat of the secondary current. So at some points the lead would be even softening and at others perhaps hardly affected; but surely destroyed in spots.

Large Cables in Fiber Ducts.

Question 221. Three rubber-covered cables, 2,000,000 circular mils each, are laid under the concrete basement floor of a reinforced-concrete building. Three-inch fiber ducts are employed and a two-inch thickness of concrete covers and separates the ducts. The length of the duct is 175 feet and the supply is 60-cycle, three-phase, 220-volt current, for power work. It is planned to use ordinary cable without lead sheath, placing one cable in each duct.

(A) Should the proposed cable be approved under these conditions?

(B) It is claimed that the use of a lead sheath will greatly increase the inductive drop on these mains, already very bad on account of having to place the cables as much as five inches apart. Is this objection well founded?

(C) What is thought of the thickness of covering of concrete provided for the protection of the cables?

Answer 1 (N). (A) Yes. (B) No. (C) I think that two inches is rather fragile, and would prefer to see three inches of concrete.

Answer 2 (D). (A) Lead-sheathed cable should be used with these conditions. (B) I do not believe the objection to the increased inductive drop attributed to the lead-sheathed cable to be well founded. (C) The thickness of concrete is considered sufficient for the required mechanical protection.

Answer 3 (E). (A) The main point to be considered, in this part of the question, as I understand it, is whether the conductors will be exposed to moisture, which fact does not appear in the question. The question of moisture would determine my judgment. (B) I am without actual experience with this part of the question. (C) I do not understand that there is any Code rule which bears upon the thickness of concrete. Too many engineers have been mistaken upon the thickness and strength of concrete for an electrical inspector to hazard an answer

Answer 4 (O). (A) Fiber conduit is approved by the Laboratories only for use in central stations, and cannot, therefore, be approved for any other kind of building. There is no rule requiring low-potential wires or cables in such conduit to be protected by lead sheath.

(B) This is an engineering question with which the inspector should not be greatly concerned, especially since he has no rule on which he could base a decision either way.

(C) With cables of this size and probably carrying a great amount of energy a covering of two inches of concrete would hardly be sufficient to prevent damage to the building in case of a burn-out or short-circuit. In this territory it is our practice to call for at least four inches of concrete for the protection of wires of size No. 6 and larger, and in the case under discussion we would probably ask that the conduits be at least six inches under the top of the floor or preferably deeper, in order that they might then be considered outside of the building, or a part of the underground system. We would then have nothing to say in regard to how the work was installed, these underground conductors not being considered a part of the building installation.

Answer 5 (B). (A) Under the conditions stated, there can be no question that a lead sheath on cables referred to opens up possibilities of trouble, that ought to be given careful consideration due to eddy currents on lead covering on cable of the capacity mentioned, installed in manner described. It would be better, in my judgment, to install cables without lead covering.

(B) There would appear to be no question but that the drop in these mains would be increased by having lead covering on cables.

(C) The rules of this department require, and it is a custom in this section, to have a thickness of not less than three inches of concrete.

Answer 6 (F). (A) Yes. (B) No, the lead sheath should not increase the loss. (C) Sufficient.

Answer 7 (P). (A) Yes. (B) Yes. (C) We would consider two inches of concrete sufficient.

Answer 8 (K). (A) In this territory the matter of deciding between lead-covered cable without the lead covering for such a piece of work as that referred to in the question would hardly ever be put to us, for it is very rare that the practice of using cable having lead covering is departed from. While we do not know that it could be done under the Code, we should be inclined to condemn the use of rubber-covered conductors having no lead armor in such a circuit. The liability of serious injury to the insulation while the conductors were being pulled in is in itself sufficient to lead one to insist upon the use of lead-armored material.

(B) Lead is not sufficiently magnetic to give rise to inductive troubles in work of the sort contemplated in the question.

(C) Considerations as to the thickness of the concrete covering over the ducts are hardly an inspection problem. The inspector would have a right, however, to insist that this be thick enough to protect the tubes properly; it seems that a thickness of two inches should prove ample protection.

Answer 9 (J). (A) The Code does not seem to prohibit the use of rubber-covered cables in ducts under concrete floors in ordinary buildings, although Rule 2*a*, apparently the only Code reference to anything of this kind in inside work, would indicate that such use is not contemplated except in central stations, and then only "in the brick or cement pier on which the generator stands." Even there, if protection against moisture is necessary, lead-covered cable or iron conduit must be used. Fiber ducts, although sleeved and treated with moisture repellants, cannot be considered as satisfactory protection if moisture is to be expected.

(B) The use of lead sheath will not materially affect the inductive loss; in fact, if sheaths could be bonded together at both ends the inductive loss would actually be less than when no sheath was used.

(C) The mechanical protection furnished to circuits of the given capacity by a two-inch covering of concrete, I would consider quite unsatisfactory. Many cases are recorded where workmen have driven picks or spuds into such a concealed circuit, with disastrous results.

Spring Hinges as a Substitute for Latches on Cabinet Doors.

Question 222. Rule 70g requires that a substantial latch or catch be provided to keep the door of a cabinet closed. Can spring hinges of substantial design be accepted as an equivalent?

Answer 1 (J). I should be inclined to accept spring hinges of substantial design as equivalent to the latch or catch required by Rule 70*g*.

Answer 2 (P). In this territory we

would consider substantial spring hinges as equivalent to a latch or catch.

Answer 3 (F). The intent of the section of the rule in question is to provide for dust-tight construction. If spring hinges, so arranged that they hold door in a tightly closed position, were used, I would say that intent of rule had been complied with; in addition to which the door becomes self-closing.

Answer 4 (E). The door of a cabinet, under Section *g*, Rule 70, should have a substantial latch or catch that will keep the door closed tightly against the rabet of the door frame. The spring hinges do not comply with the rule.

Answer 5 (O). This question as well as all other details pertaining to the construction and manufacture of fittings and materials should properly be referred to the Underwriters' Laboratories for decision.

Answer 6 (D). Spring hinges cannot be considered as a substitute for the latch or catch required on cabinet doors.

Answer 7 (B). While Rule 70*g* specifically refers to a latch or catch, a device which in my judgment would obtain as good results would be permitted in this section. If the springs would keep the door closed properly, they should be approved.

Answer 8 (N). I cannot see but what the intent of the Code is fulfilled by the use of such a device. A number are installed in my territory with entire satisfaction.

Answer 9 (K). The Code evidently intends, in Rule 70*g*, to emphasize the importance of keeping the door of the cabinet shut rather than to be very specific as to how this must be done. Our experience has been that where latches or catches are used the doors are very frequently left standing open a large part of the time. By means of substantial springs it can be made certain that the door will always remain shut; provided, of course, it is not too heavy to be operated successfully with springs. We have to say, therefore, that for the smaller cabinets with the lighter doors we prefer springs rather than latches or catches to keep them closed. On the doors of very large cabinets springs might not be practical.

Public Service Commissions

CALIFORNIA.

The Railroad Commission has rendered a decision granting the application of the Tulare County Power Company to issue $300,000 of bonds, for the purpose of paying existing obligations and extending its transmission lines.

The Pacific Gas & Electric Company applied for a rehearing of the case involving the reduction of rates of the Northern California Power Company. The applicant stated that the rates were unremunerative to both the Northern California Power Company and itself, and asked that the rate order be suspended in so far as it applied to Butte and Colusa Counties.

A decision was rendered granting a certificate of public convenience and necessity to the Coalinga Water & Electric Corporation to exercise franchise rights previously granted in Monterey, San Luis Obispo and Santa Barbara Counties.

A supplemental order was issued allowing the City Electric Company to sell $833,000 of bonds which had previously been authorized to be pledged as collateral security for a loan.

MICHIGAN.

John Carton of Flint, representing water-power companies, appeared before the Railroad Commission and obtained permission to issue stock in the following amounts:

Pontiac Power Company, $6,000; Saginaw Power Company, $12,000; Consumers Power Company, $5,000; Commonwealth Power Company, $102,000; Au Sable Electric Company, $13,000; Economy Power Company, $130,000; Au Sable Electric Company, $126,000; Grand Rapids-Muskegon Power Company, $48,000; Bay City Power Company, $4,000; Flint Electric Company, $7,000.

MASSACHUSETTS.

The Massachusetts Gas and Electric Light Commission has approved the issue by the Worcester Electric Light Company, of 2,000 shares of new capital stock of the par value of $100 each, at a price of $200 per share, the proceeds to be applied to the cancellation of obligations represented by promissory notes outstanding December 31, 1912.

The Massachusetts Gas and Electric Light Commission has filed an answer, in the United States District Court, to the bill of complaint of the Haverhill Gas Light Company, which seeks to test the Commission's authority to fix the price of gas at eighty cents per thousand feet. The Commission denies that a constitutional question is involved in the order for reduction in prices, and states that conditions permit of the reduction by the Gas Company.

The Massachusetts Gas and Electric Light Commission has approved the issue, by the Plymouth Gas Light Company, of 200 shares of new capital stock of the par value of $100 each, the proceeds to be applied to payment of obligation incurred in making addition to plant. The Massachusetts Gas and Electric Light Commission has approved the issue by the Gardner Electric Light Company of 400 shares of preferred capital stock at $105 per share, and 400 shares of common stock at $150 per share, which prices were determined by the directors of the company, the proceeds to be applied to the payment of obligations represent by promissory notes outstanding December 31, 1912. On March 8, 1911, the Commission approved of an issue of capital stock, part of which was to be devoted to the extension of the company's distributing system to the towns of Westminster, Hubbardston, Barre and Winchendon and to other additions to its local plant, made subsequent to December 31, 1910. The company has meantime constructed a high-tension distribution line from a point in Gardner, where it connects with the main line of the Connecticut River Transmission Company, to Barre, at an expense of over $52,000. It has constructed distribution systems in the towns of Westminster, Hubbardston and Barre at an expense of over $35,000, and it has also made additions to its generating station and distribution system in Gardner, at a

cost of about $37,000. The excess of these expenditures over the proceeds of the stock already approved therefor, is more than $102,000.

The Massachusetts Gas and Electric Light Commission has authorized the Lynn Gas & Electric Company to distribute and sell gas in the town of Lynnfield. The company is a consolidation of the Lynn Gas Light Company and the Lynn Electric Lighting Company. The consolidated company was authorized to generate and furnish gas and electricity in the same territories in which the constitutent companies were authorized to operate. The Electric Lighting Company confined its business to the city of Lynn, but since consolidating the company has furnished both gas and electricity in Nahant, Saugus and Swampscott and has recently acquired the gas company in Marblehead. Since the hearing the company has waived that portion of its petition which asked authority to carry o its electrical business in Lynnfield, and the authority granted applies only to gas.

The Commission has sustained the appeal of the Buzzards Bay Electric Company from a decision of the selectmen of Barnstable, giving permission to the Barnstable Electric Company to use certain public streets of the village of Hyannis for the transmission of electricity. The issue involved is whether the Barnstable Company shall be admitted into territory already served by the Buzzards Bay Company. The Board finds that the latter company has shown itself able and willing to supply electricity throughout the town of Barnstable and that the Barnstable Company showed no superior facilities. Before the Buzzards Bay Company established itself, in 1909, the whole section was served by the Cape Light, Heat & Power Company of Princetown. The Board says that experience has shown that to supply such a thinly populated territory with a maximum of efficiency and economy a single company with a properly located central station is preferable to numerous companies each supplying small areas.

The Massachusetts Railroad Commission has granted the petition of the Berkshire Street Railway Company to act as common carrier of baggage, express and freight in the town of Williamstown, Mass. The authority granted is given upon the condition that it shall operate to enhance the value of the assets of the company in the event of the purchase of the railway property by the town or state.

The Massachusetts Railroad Commission has approved of the issue by the Bay State Street Railway Company, at $115 per share, of 6,600 shares of six-per-cent cumulative preferred stock, for the purpose of paying floating indebtedness incurred in the construction and equipment of the railway, and in the purchase of property necessary for its operation.

NEW JERSEY.

The Board of Fublic Utility Commissioners has dismissed the complaint of Raritan Township, Somerset County, against the Public Service Electric Corporation, charging that the street-lighting rates proposed by the company in a new schedule were excessive and discriminatory. The complaint was filed December 16, 1911, and was later entered into by Kearny, Harrison, East Newark, Montclair, Roselle Park, and Jersey City. In accordance with recommendations of the Board, the company submitted it the new rate schedule with full information as to basis for the proposed scale. In view of the increases shown in various instances, the Board, on its own motion, instituted an investigation, leading to the following decision:

The new schedule of rates submitted shows a total net decrease of $100,-200.98. While increases are made in the charges to some of the municipalities served, the total of these increases is small, as compared with the total reductions. These increases are not therefore deemed sufficient cause for setting aside the schedule, which will not, as a whole, bring to the company an unreasonable return on a reasonable or legitimate investment. The investment cost of conduits and pole lines which should be allowed to street-lighting service produces a lower average cost per lamp for a municipality with a large number of lamps as compared with a municipality having a smaller number. A sliding schedule granting lower rates for larger installations is not unduly discriminatory or preferential, but a uniform price to all municipalities, irrespective of the number of lamps and without reference to terms of the contract, would be unduly discriminatory.

The report submitted the Board of Public Utility Commissioners by the company shows: 31 contracts for 890 arc lamps, charge under old contracts, $74,539, charge under new schedule, $65,886, a total reduction of $8,653; 40 contracts for 10,708 lamps of 2,000 candlepower, charge upder old contracts, $834,309, charge under new schedule, $773,808, a total reduction of $60,501; 55 contracts for 1,798 incandescent lamps, charge under old contracts, $124,899, charge under new schedule $113,510, a total reduction of $11,389. The itemizing of this latter schedule shows small increases for about 16 towns in the company's territory.

NEW YORK.

The Public Service Commission for the First District has adopted a resolution approving of the construction of the plant of the Long Acre Electric Light & Power Company, and authorizing the company to issue $4,000,000 in bonds and $2,000,000 in stock, the proceeds of which are to be devoted largely to the extension and improvement of the company's plant. The Commission also approved a mortgage by the Long Acre Company to the Empire Trust Company, dated July 1, 1911, to secure an issue of $50,000,000 in 50-year five-per-cent bonds. No bonds can be issued under it, however, until authorized by the Commission. The $4,000,000 of bonds now authorized are the first to be authorized under this mortgage. A previous mortgage to the Metropolitan Trust Company, dated October 15, 1906, to secure an issue of $1,000,000 of four-per-cent bonds, must be either cancelled or subordinated to the new mortgage.

The Public Service Commission, Second District, has just made an order authorizing the Otsego & Herkimer Railroad Company to make a mortgage for $2,500,000, and issue, subject to the security thereof, bonds of a par value of $1,200,000.00. A part of the proceeds of the bonds is to be used to acquire all the property of the Hartwick Power Company, so that these two properties will be reunited.

The Colliers Light, Heat & Power Company has been authorized to issue $35,000 of stock and $135,000 of mortgage bonds to acquire the property of the Clinton Mills Power Company, which operates in Coopertown, and the Richfield Springs Electric Light & Power Company, which operates in Richfield Springs. The property of both of these companies now taken over by the Colliers Light, Heat & Power Company has been entirely revamped, so that the principal source of supply of electricity will be current purchased from the steam plant just acquired by the Otsego & Herkimer Railroad Company from the Hartwick Power Company, which is located at Hartwick and Colliers, N. Y. The water power and steam plant formerly owned by the Clinton Mills Power Company will be used to supplement and as a reserve for the power to be taken from the railroad company.

OKLAHOMA.

The Corporation Commission has refused to entertain an application for a general order raising the rates for switching rural telephone lines through exchanges of companies in the cities

and towns of the state, as asked by the Telephone Association. It was claimed that the present charge, 25 cents, is inadequate and that the switching charge should be made from 35 to 50 cents. The Commission announces, however, that it will consider individual complaints, which may be filed by any particular exchange. In a letter to owners of exchanges, stating the position of the Commission, Commissioner Henshaw says that such an order could not be issued without doing injustice to hundreds of small mutual telephone lines which are not operated for profit and that connection of the various exchanges in cities and towns with these rural lines add to the value of the service of the exchange and benefits the company which gives this service, through an increase of patronage. The action of the Telephone Association in asking for a general increase in switching charges brought out a storm of protests from the rural lines over the state.

Electric Sign in Fremont.

A magnificent new chime clock and electric sign has been installed in front of the Colonial Bank & Trust Company, on North Front Street, Fremont, O. The clock is operated by a master clock in the interior of the building.

World's Coal Production.

The total known coal production of the world (exclusive of brown coal or lignite) was about 1,050,000,000 tons in 1911, of which the United Kingdom produced more than one-fourth and the United States nearly two-fifths. Compared with population, the production of coal in the United Kingdom amounts to 6 tons per head, while in the United States it is under 5 tons per head. The five principal coal-producing countries show a production in 1911 as follows: United Kingdom, 271,899,000; Germany, 158,164,000 (provisional figures); France, 38,023,000 (provisional figures); Belgium, 22,683,000; and the United States 496,221,000 tons.

Among the Supply Men

The Republic Electric Company is one of the newcomers in the electrical supply field, starting business in Cleveland, O., on January 1. This company has established an attractive store and warehouse at 2067 to 2069 East Ninth Street, and will handle a complete line of electrical supplies. The officers are L. Griesser, president; H. W. Allen, vice-president; W. L. Sinnott, secretary and treasurer, and A. C. Kinzel, sales manager. These gentlemen were all formerly connected with the Cleveland Electrical Supply Company.

M. G. Goldback, president of the Atlantic Electric Company, Incorporated, 56 Commerce Street, Norfolk, Va., announces that it has been decided to discontinue the company's contracting department and act exclusively as electrical supply jobbers, carrying a complete line of electrical supplies.

W. W. Low, president of the Electric Appliance Company, Chicago, and Mrs. Low left Chicago on Saturday, February 22, for a month's trip to the Coast.

The Illinois Electric Company, Chicago, has secured the agencies in the Central States for Adams-Bagnall transformers and Bell single-phase motors. A complete stock of these lines will be carried in Chicago.

The Standard Electrical Supply Company, 1204 Race Street, Philadelphia, Pa., has enlarged its facilities and increased its local business considerably. The company has added a couple of salesmen to its city sales force, and has also taken on additional inside help to keep pace with the growing business.

C. D. Williams, secretary and treasurer of the P. & W. Electric Company, Toledo, states that the company has recently purchased a half interest in a large independent lamp factory and will control its sales output. The company has increased its sales force and will now travel 16 states. The company states that it has greatly improved the "Paweco" line of flashlight cases, equipping them with entirely new switches, reflectors, etc. The selling organization has contracted for nearly one-half the output for the year. Mr. Williams reports business from northwestern territory unusually good. Many large jobbers have placed contracts for their fall requirements of this company's goods. The company held a sales meeting the last week in January and the results of this conference have been demonstrated in increasing sales ever since. H. M. Price will leave the latter part of this month for a long trip to Washington and California, returning over the southern route.

F. T. Andrae, secretary of Julius Andrae & Sons Company, Milwaukee, Wis., has just returned from an extended trip through New York, Philadelphia, Pittsburgh and Cleveland. The new No. 34 telephone catalog of the company is now ready for mailing.

L. A. Schwab, president of the Monarch Electric & Wire Company, Chicago, Ill., informs us that as a result of a campaign which his company has been conducting on Hunter and Tuerk fans it has received a larger number of contracts than ever before in the history of the company. The company has also received an unusually large number of orders for weatherproof wire and galvanized strand as the result of a recent campaign on this material. The supply business in general is very satisfactory.

The Baltimore Electrical Supply Company, of Atlanta, Ga., was organized and opened business on March 1, 1912, as jobbers in electrical supplies. The company, of which W. J. Flanery is president, and J. J. Smith is general manager, has a sales organization covering five southern states and since its formation, just over a year ago, it has realized all expectations in amount of business done, with unusually good prospects for the coming year.

The Co-operative Electric Company was recently organized by W. T. Proctor, F. B. Davis and H. F. Gheesling, to do a jobbing business in electrical supplies. The company has well located quarters at 65 Walton Street, Atlanta, Ga., and its sales organization will cover several southern states. Mr. Proctor is well known among the electrical trade in the South, where he has traveled for several years, and he will continue to cover the same territory that he has in the past.

BOOK REVIEWS.

"The Application of Hyperbolic Functions to Electrical Engineering Problems." By A. E. Kennelly, London: University of London Press. Cloth, 278 pages (5½x8½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.25.

Professor Kennelly has performed a good service in making this material available in book form. The substance of the volume comprises a course of lectures delivered before the University of London. It shows in a clear and comprehensive way the application to a number of electrical problems of these functions, which are so seldom understood or used by the practicing electrical engineer. The first chapter is devoted to an explanation of hyperbolic functions and this is followed by their various applications. About one-third of the volume is devoted to telephony and telegraphy, where, perhaps, their use has been of the greatest service. The application, however, to alternating-current lines of frequencies ordinarily used in power transmission is also considered, as in the cases so neatly worked out both experimentally and mathematically by the author in his recent paper before the American Institute of Electrical Engineers. The application of these functions to the problem of sag on transmission lines might well have been included and would doubtless have served to elucidate a problem now somewhat obscure, but as this is a mechanical rather than an electrical problem its omission cannot be said to detract from the completeness of the treatment. The volume should serve to acquaint electrical engineers with the possibilities of this form of computation and its reading should not be difficult for anyone whose mathematical preparation includes trigonometry and calculus.

"Transmission Line Construction." By R. A. Lundquist. New York: McGraw-Hill Book Company. Cloth, 295 pages (6x9 inches), 183 illustrations. Supplied by the Electrical Review Publishing Company for $3.00.

This is a very practical book on a very practical subject. The author has taken up the various questions to be met by the construction engineer in dealing with an electrical-transmission line and has not only pointed out the method of doing the work but has included many data regarding the cost which will be found of much interest and value. This is a feature which is too often lacking in books which are claimed to be practical. Separate chapters are devoted to wooden poles, steel poles, steel towers and reinforced concrete for overhead lines. The other nine chapters deal with various details, cost data of completed lines, location of lines and other incidental subjects such as organization and tools. A series of appendixes gives specifications for various materials. The book will not only be valuable to the construction man but should be of great assistance to the designer, although the calculations involved in such design are not touched upon. The author is one who has had considerable experience in work of this kind and his opinions may be regarded as authority in this class of work.

H. E. Niesz Addresses Chicago Jovians.

A co-operative movement, to be participated in by all electrical and allied engineering organizations in Chicago, having as its object the establishment of a permanent club and meeting building, was advocated by Homer E. Niesz before the Jovian Lunch Club, of Chicago, on March 10. Mr. Niesz's recommendation is in line with the movement of the Electric Club of Chicago for permanent quarters, his contention being that it would be far more desirable to enter into a joint movement for an electrical building than for any organization to attempt the plan singly.

A. A. Gray endorsed the recommendation of Mr. Niesz and called attention to the establishment of a permanent Jovian organization in Chicago, which will give impetus to the forthcoming rejuvenations.

The permanent organization is comprised of George C. Richards, chairman; A. R. Dean, vice-chairman, and C. A. Cummings, secretary.

Lightning Protection.

Ernst J. Berg, professor of electrical engineering, University of Illinois, delivered a very interesting address on "Lightning Protection," before the Electric Club of Chicago on March 6. Inspired by frequent requests for information relative to the value of lightning rods, methods of installation, etc., Dr. Berg has made a thorough study of lightning phenomena. The results, as related to the Club, were given in an article in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, November 16, 1912.

Following the address of Dr. Berg discussion was resumed on the question of establishing permanent Club quarters. After the discussion a vote was taken and although a post-card ballot showed a majority of the members to be in favor of permanent quarters, a majority of those present voted against the proposition.

The Relative Security of Securities.

The firm of Henry L. Doherty & Company, New York bankers, has issued a group of charts illustrating in an original manner:

(a) The relative security of certain different classes of stocks and bonds; and

(b) The relative steadiness and rate of increase in the net earnings of some of these classes of stocks and bonds.

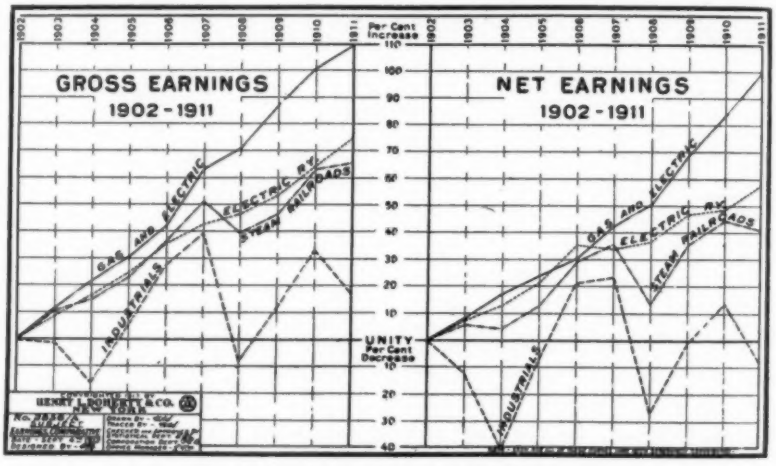


Fig. 1.—Growth of Gross and Net Earnings.

Fig. 1 shows, year by year, for ten years how the gross and the net earnings increased and decreased for typical gas and electric companies, electric street railways, steam railroads, and the big "industrial" companies listed on the New York Stock Exchange.

In the statement which Doherty & Company issues with this chart it calls attention to the steadiness and rapid rate of increase of both the gross and net earnings of gas and electric companies and contrast this with the fluctuating earnings of the "industrial" companies and steam railroads.

But perhaps even more interesting than Doherty & Company's study of gross and net earnings is the study of the relative security of different classes of investments.

Fig. 2 shows the result of this study, year by year, for the thirty years from 1882 to 1911, indicating the percentage

of capital in the hands of receivers to the total contemporaneous capital of each group. For national banks two ratios are shown, (a) the percentage of national bank capital foreclosed by the Government because of national banks found to be insolvent, and (b) the percentage of national bank capital voluntarily liquidated.

Year by year and item by item it compiled the total par value of all stocks and bonds outstanding throughout the United States for all gas and electric companies, for all steam railroads, the stocks of all national banks, and the stocks and bonds of all "industrials" of sufficient magnitude to be mentioned in the financial journals, corporation manuals, etc.

Likewise, year by year, it compiled for each of these groups the total securities which were insolvent or in receivers' hands, and calculated the ratios of these insolvent securities to the corresponding total securities outstandings. Doherty & Company made thorough preliminary inquiry of those agencies which would be supposed to have such data as to failures, but found that such compilations had never been made, and it was therefore necessary for it to make this original statistical study of the relative security of securities for the last thirty years.

In the total it involves the equivalent of over five hundred and forty-five billion dollars ($545,310,371,443.00) of capital, of which it found over nine billion five hundred and seventy-eight million dollars ($9,578,713,793.00) insolvent, or an average for the whole of $1.75 out of every hundred dollars of stocks and bonds outstanding.

Fig. 3 illustrates the relative annual average risk of receiverships, insolvency or liquidations during the last thirty years as deduced from the data of Fig. 2.

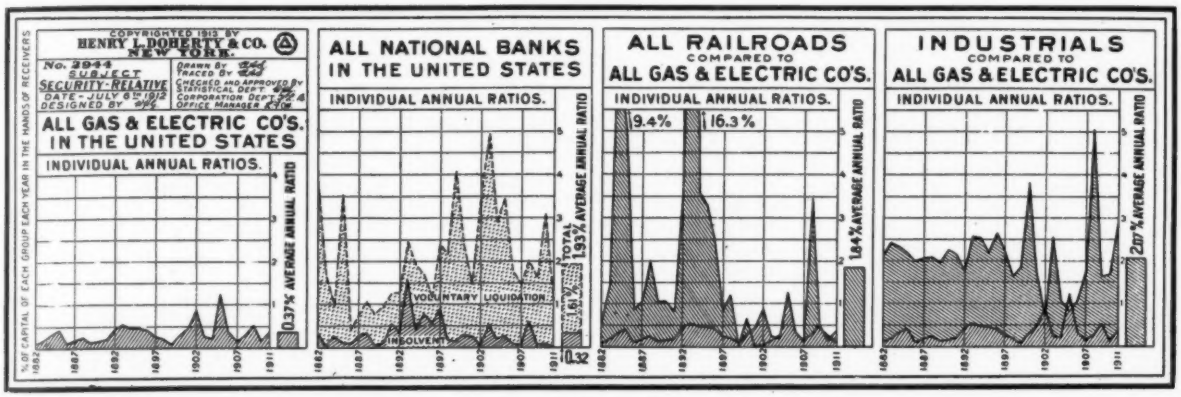

COPYRIGHTED 1913 BY HENRY L. DOHERTY & CO. NEW YORK.
ALL GAS & ELECTRIC CO'S. IN THE UNITED STATES
INDIVIDUAL ANNUAL RATIOS.
0.37% AVERAGE ANNUAL RATIO
ALL NATIONAL BANKS IN THE UNITED STATES
INDIVIDUAL ANNUAL RATIOS.
VOLUNTARY LIQUIDATION
INSOLVENT
1.61%
0.32
TOTAL 1.93% AVERAGE ANNUAL RATIO
ALL RAILROADS COMPARED TO ALL GAS & ELECTRIC CO'S.
INDIVIDUAL ANNUAL RATIOS.
9.4%
16.3%
1.84% AVERAGE ANNUAL RATIO
INDUSTRIALS COMPARED TO ALL GAS & ELECTRIC CO'S.
INDIVIDUAL ANNUAL RATIOS.
2.07% AVERAGE ANNUAL RATIO
% OF CAPITAL OF EACH GROUP EACH YEAR IN THE HANDS OF RECEIVERS

Fig. 2.—Relative Security of Different Classes of Investments.

From figures of all gas and electric companies in the United States Doherty & Company found that an annual average of but 37 cents out of every $100 of all gas and electric stocks and bonds has been in the hands of receivers. Obviously, the net loss—especially to bondholders—has been much less than 37 cents per $100.

The figures it deduced from the record of all national banks in the United States show that out of every $100 of their securities outstanding an annual average of 32 cents has been declared insolvent by the Government; and, in addition, $1.61 has been voluntarily liquidated, making a total of $1.93 per $100 of national bank capital. As the stockholders of insolvent national banks are by law liable to an assessment equal to the par value of their holdings, the real loss from insolvent banks has been probably between 32 cents and 64 cents per $100.

The annual average risk of receivership as deduced from the figures of all steam railroads in the United States is $1.84 per $100 of their stocks and bonds outstanding.

The corresponding figure for all "industrials" large enough to be mentioned in financial papers and manuals is shown as $2.07 per $100 of stocks and bonds outstanding.

From the foregoing Doherty & Company points out that investments in gas and electric companies are on the average more secure than are investments in the stocks of carefully supervised national banks. It is also apparent that gas and electric securities are about five times as free from receiverships as are steam railroad securities; and that they are over five and a half times as free from receiverships as are investments in the larger "industrials."

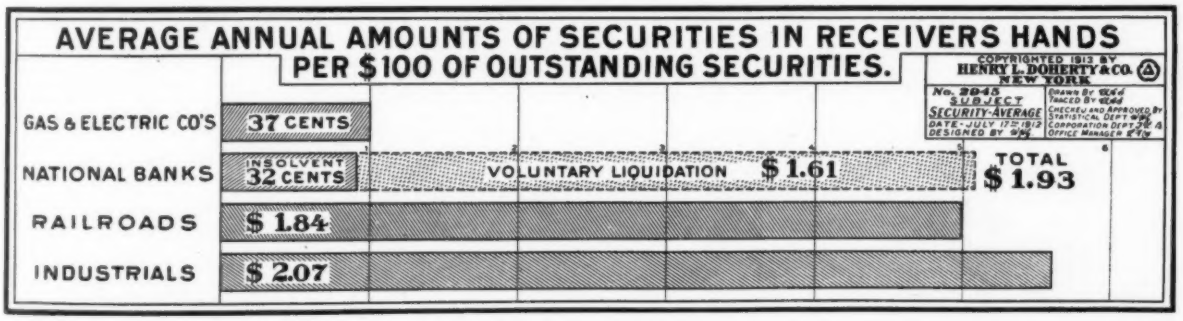


Fig. 3.—Relative Risk of Insolvency.

Electrical Securities Sold in London.

A report of the securities offered on the London money market during 1912 shows that electric light, power and telegraph securities amounted to £9,416,600 sterling. Of this £7,515,300 was in bonds, £205,600 in preferred stock and £1,695,700 in common stock.

JOVIANISM AND CO-OPERATION.[1]

By Elbert Hubbard.

In the year 1899 there was organized at Austin, Tex., a society known as "The Jovians." It was simply a local organization of men who were engaged in the business of harnessing electricity.

The particular excuse for founding the society was to entertain a convention of manufacturers and jobbers that was to meet in Austin.

The charter membership was 44. These men were more or less in competition with one another, but they said: "For the time we will sink our prejudices and fears of one another and get together and take care of the visitors."

And so when the men got together and looked into one another's faces, and laughed and joked, they really liked one another first-rate, and they discovered that, although men may be in competition with one another, yet if they are working in the same line of business, there is something which they have in common that makes for respect and confidence. Especially is it true that after you have played with a man you cannot go away and lie about him nor defame him.

And lo! There were other Jovian societies founded in the immediate vicinity. Wherever there was a central power plant it was suggested that there should be an association of the Jovians. And so the idea has gradually spread until the Jovians now number in the United States over eight thousand members.

Any man engaged in the business of generating electricity, selling the current, contracting, constructing, or dealing in electric supplies is eligible.

The motto of the Jovians is: "All together, all the time, for everything electrical."

The order of Jovians is purely social, but there is no doubt that every member is inspired to a little better work and in a little bigger and more generous way than ever before. He gets rid of his whims, his prejudices, his fears and his doubts.

Goodfellowship is an asset; also, it is an education. The Jovians are essentially democratic.

The boys who string wires are eligible. Also all central-station men, employees of street railways, heads of departments, office, sales, factory forces and members of jobbing concerns. Also most telephone interests march proudly under the Jovian banners.

Thomas A. Edison, George Westinghouse, C. A. Coffin, Dr. Steinmetz, Samuel Insull, Elihu Thomson and other human motors of high voltage belong to the Jovians.

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The idea of electricity binding the world together in a body of brotherhood is something we did not look for a few years ago. Electricity occupies the twilight zone between the world of spirit and the world of matter. Electricians are proud of their business. They should be.

Men are surely getting acquainted and getting together as never before in history. All together, all the time, not only for everything electrical, but everything human—why not?

I am a Jovian.

Experiments Showing that Complete Relativity Does Not Exist in Electromagnetic Induction.

In a recent issue of *Science*, S. J. Barnett, professor of physics in the Ohio State University, described some experiments which he regards as establishing the fact that the idea of relativity is not applicable to electromagnetic induction.

The subject of relativity has attracted much attention among physicists recently in the endeavor to explain the apparently contradictory experimental results obtained in several optical experiments. The experiments carried on by Professor Barnett were as follows.

Two series of experiments were made, one without iron and the other with iron. In the first series a cylindrical condenser was mounted symmetrically in the approximately uniform magnetic field within a cylindrical electric coil coaxial with the condenser's armatures. The condenser, maintained at rest, was short-circuited, and the coil, traversed by an electric current, was rotated about its axis at uniform speed. The inner armature of the condenser was then insulated from the outer, after which the magnetic field was annulled and the rotation stopped. The inner armature was then tested for electric charge.

The second series of experiments was similar to the first, except that the magnetic field was produced by two symmetrical electromagnets mounted coaxially with the condenser and rotated together at the same speed.

In neither series of experiments was there detected upon the condenser any charge as great as the experimental error.

Now it is an immediate consequence of the classical experiments of Faraday and others upon the electromotive force developed in a metal disk rotating in a magnetic field produced by a *fixed* electric coil or magnet, together with experiments of Blondlot, H. A. Wilson, and the author, upon the electric charges developed on adjacent conductors by the motion of insulators in magnetic fields produced by fixed coils or magnets, that, if the complete condenser and its short-circuiting wire had been rotated while the coil or magnets remained fixed, the armature tested would have received a charge equal to the continued product of the capacity of the condenser as it would be with air or free ether as dielectric, the magnetic flux through the space between the armatures, and the number of revolutions of the condenser per second. Moreover, it follows from the above-mentioned experiments on insulators that if the condenser's dielectric is air, it is of no consequence whether the air rotates with the armatures or not.

It was thus easy to calculate the charge which would have been developed upon the condenser in each of my experiments for the same relative motion between it and the complete field-producing agent, but with this agent at rest and the condenser in motion.

The investigation proved conclusively that the condenser system, when it remained at rest and the agent producing the field rotated, received not more than a minute fraction of the charge it would have received for the same relative motion if the agent producing the field had been the part to remain at rest. Within the limits of error of the experiments—about 1.4 per cent in the experiments with the electric coil, and about 1 per cent in the experiments with the electromagnets—this fraction was zero.

Glass and Porcelain Insulators.

Experiments upon the electrical and physical properties of glass and porcelain insulators of European and American manufacture have been made by G. Rebord and described in the *Atti dell' Associazione Elettrotecnica Italiana*. To clear up some discrepancies on the disruptive voltages obtained with needle points by H. W. Fisher, new experiments were made with points really pointed and not blunt, such as were frequently found in commercial needles. A table, and the curve plotted therefrom, are given, showing the results obtained, which can be expressed by the following formulas.

From 0 to 25 kilovolts, $X = 1.3\ V$, where V is effective pressure in kilovolts and X the sparking distance in millimeters, from 50 to 150 kilovolts, $X = 3.2\ (V - 25)$; from 30 to 50 kilovolts, $X = 2\ (V - 10)$.

The summary of the insulator tests may thus be given. Glass insulators have a superficial resistance not inferior to that of porcelain under various conditions of humidity, and the glass does not retain moisture to any greater extent. The sparking distances over glass and glazed porcelain are from 10 to 30 per cent lower than the sparking distances in air; ebonite, ambroin, and unglazed porcelain show similar behavior. When smooth, the curved surfaces of glass and porcelain are equivalent. The mechanical strength of glass is satisfactory and the surface is not attacked, but glass will not stand sudden changes in temperature as well as porcelain does.

Dinner to Baltimore Contractors.

An elaborate banquet was given to the electrical contractors of Baltimore, Md., on February 28, at the Hotel Belvedere by the Consolidated Gas, Electric Light & Power Company, the central station of that city. It is always the object to co-operate with the electrical contractor and public and the discussion of co-operation was the main topic of the evening. About 100 contractors and engineers were present, among whom were the most prominent consulting engineers of the city. R. F. Bonsall, business manager of the Consolidated Company, acted as toastmaster. A letter of regret was read from J. E. Aldred, president of the Consolidated Gas, Electric Light & Power Company, regretting that he would not be able to attend as he was traveling in Europe.

Banquet of Consolidated Gas, Electric Light & Power Company for Baltimore Contractors.

The seating arrangement was such that at least one of the central-stations officials was seated at each table, whose duty was to see that every one at his table was well cared for and that each individual enjoyed the banquet. The banquet hall was beautifully decorated with thousands of miniature electric bulbs and the spirit of co-operation prevailed.

During the course of the evening toasts were responded to by the following: "The Consolidated Company," Herbert A. Wagner, vice-president of the Consolidated Gas, Electric Light & Power Company; "The Baltimore Contractor," W. D. Young, president of the Baltimore Electrical Contractors' Association; "The Co-operative Movement," Melvin H. Jones, Maryland Statesman of the Jovian Order; "The Philadelphia Underwriters," Washington Devereux, Philadelphia Underwriters' Association; "The New York Underwriters," J. C. Forsythe, of New York City; "The National Contractor," B. L. Bates, of Philadelphia; "The Supply Man," William J. Flannery, of the Baltimore Electrical Supply Company.

An orchestra furnished music during the banquet and toward the close of the evening several acts from local theaters were presented and enjoyed by those present. The menu was artistically gotten up and was in keeping with the occasion.

Power-Factor of Alternating-Current Systems.

At a recent meeting of the British Institution of Electrical Engineers a paper was read by Miles Walker on "The Design of Apparatus for Improving the Power-Factor of Alternating-Current Systems." The paper was confined to a statement of the principles involved and a description of the phase-advancer built by the British Westinghouse Company. Professor Walker pointed out that the main reason why the phase-advancer had a fair chance of commercial success was that it was a machine of small output in comparison with the amount of change of wattless load which it was capable of effecting when used in conjunction with an induction motor of suitable size. A phase-advancer of only 30-kilovolt-ampere capacity was capable of changing the power-factor of a 1,300-kilovolt-ampere motor from 0.88 lagging to 0.95 leading. That is to say, the motor, instead of requiring to be fed with lagging wattless current to the amount of 600-kilovolt-amperes would relieve the generators supplying the system of a wattless load of 400-kilovolt-amperes, making a total change in the wattless power of 1,000-kilovolt-amperes. The reason was that the phase-advancer stood in the same relation to an induction motor as an exciter did to a synchronous motor. An exciter of comparatively small capacity could over-excite a synchronous motor so as to make it supply a wattless load 50 times as great, measured in kilovolt-amperes, as the rating of the exciter. Now if for some mechanical work a large induction motor must be employed, the extra cost of making that motor run at unity, or even at a leading, power-factor was not very great. It was merely a question as to the cost of an advancer of which the rated output was some 3 to 6 per cent of the rating of the motor, and the cost of a three-phase double-throw switch. The cases that would be found most suitable for the addition of a phase-advancer to induction motors were those where the motors were intended to run continuously in one direction throughout the greater part of the day. If a motor was intended to be started and stopped frequently, or reversed, it was not suitable. Large induction motor-generators, might very well be fitted with phase-advancers to improve the power-factor of the system to which they were connected; also large induction motors driving fans.

Copper Production in California.

For several years there has been a gradual decline in the copper output of California owing to the closing down of large smelting plants by litigation over damages by smelter fumes. In 1912, however, an increase in output of copper is apparent over the yield of 1911, notwithstanding the permanent cessation of operations in 1911 of one of the very large plants of the state.

SOCIETY FOR ELECTRICAL DEVELOPMENT.

Conclusion of Conference in New York City Last Week.

The conference of the Society for Electrical Development, Incorporated, was held in New York City on March 4 and 5. A report of the sessions on March 4 and the morning of March 5 was given in last week's issue.

The program on Tuesday consisted of an opening address by the president, Henry L. Doherty, who was followed by the general manager of the Society, J. M. Wakeman. The latter spoke on "The Aims of the Society." Frank H. Gale, advertising manager of the General Electric Company, presented a paper entitled "The News Value of Electricity.' A discussion followed the presentation of each of these addresses.

At the afternoon session on Tuesday the following papers were presented: "Electricity and the Architect," by Frank E. Wallis, of the architectural firm of Wallis & Goodwillie; "The Dissemination of News," by Talcott Williams, director of the School of Journalism in Columbia University; "Where the National Electric Light Association Comes In," by T. Commerford Martin, secretary of the National Electric Light Association. An interesting discussion followed the presentation of each of these papers.

At the session on Tuesday evening Mr. Martin presented a summary of the ideas and suggestions which had been received by mail from members, electrical associations and luncheon clubs in various parts of the country. These dealt with proposals for the future activities of the Society and the means by which it could best further the purposes for which it had been organized.

The session on Wednesday morning was opened by a paper by J. Robert Crouse, of Cleveland, O., entitled "Co-operation in the Electrical Industry." Owing to the inability of Mr. Crouse to be present this paper was read by F. E. Watts, jupiter of the Jovian Order.

Merchandising Co-operation.

A paper was presented by James H. Collins entitled "The Sales End." This was followed by an address by W. E. Robertson, vice-president of the Robertson-Cataract Company, entitled "Merchandising Co-operation." The two latter papers were discussed together, the central-station standpoint being put forth by Henry L. Doherty and W. H. Johnson, of the Philadelphia Electric Company. The contractor's point of view was presented by J. R. Strong, of New York City, while Charles W. Stone, of the General Electric Company, spoke for the manufacturers.

Mr. Doherty agreed with Mr. Robertson regarding the basic principle of merchandising goods, namely, that the price at which appliances are sold should be such as to cover all expenses. He considered the middleman a necessary factor in the distribution of merchandise. He stated that many central stations are in such a position that they do not know how to solve their own problems. The antagonism of the public to the public-utility corporations is spreading to the middleman. He thought the reason for such antagonism was the failure on the part of corporations to come frankly before the public, stating the reasons for their existence and the underlying policies which inspire their attitude towards the public and the operation of their companies. The middlemen are suffering from the same lack and it would be well for them if their position could be fully stated and brought to the attention of the public. Incidentally he advocated power being given to the manufacturer of a patented article to fix the resale price therefor. In refutation of Mr. Robertson's claim that the public preferred to deal with independent stores rather than with central-station companies, he pointed out that in many cases the companies in which he was interested had found that the public preferred to deal with the central station rather than with the neighboring dealer. He thought this was because deep down in their hearts they believed in the integrity and stability of the central station. The clamor against the public-utility corporations comes from a small fraction of the public, and the noise made by this class is likely to be overrated. This does not indicate distrust on the part of the larger portion of the public. Low prices do not compensate for poor service and he thought it was a great mistake to crowd the manufacturer to the limit on the question of price. The most important feature of merchandising is systematic canvassing. One great failure on the part of the dealers and contractors has been that they never undertook this portion of the business. The central station usually does this and moreover as time goes on usually creates supervisors of service charged with seeing that the service is good and having the duty to visit old customers and point out where new appliances can be installed to advantage, thus benefiting the customer by improved service and bringing additional new business to the company. Advertising and soliciting are really aspects of the same thing and they constitute part of the cost of putting any device in the hands of the consumers. Many contractors and dealers want the margin of profit represented by this cost, without themselves undergoing the expense of soliciting.

When the new metal-filament lamps came in, many of the companies were ready to co-operate with dealers on the basis of utilizing the new lamps to secure better light rather than cutting down the consumption of current, but many contractors dealt with the public on the basis of decreasing their consumption without improving the illumination which they were receiving. This forced the central stations to the attitude of handling tungsten lamps without profit as they would have been financially embarrassed by any serious decrease in the consumption of energy. The marketing of a poor quality of goods does harm to the central station and it is necessary for it to exercise some control over the devices which are to be on its lines. Mr. Doherty said that he had not yet been able to work out a complete co-operative scheme which would be satisfactory to all the classes represented in the electrical field, but he hoped that the Society would be able to do so. He said that the present development would have been impossible if the central station had depended upon the jobber and dealer, but it might have been still better than it has been if the combined efforts of these classes and the central station had been in accord to secure such a result.

Mr. Johnson explained the relation which had been worked out by the Philadelphia Electric Company and the contractors in that city, which was based on the policy of "live and let live." The company had abandoned all wiring and merchandising except with respect to lamps. No other solution of the lamp problem had been found than that the central station handle the lamps itself. He did not agree with Mr. Robertson in the attitude of the public toward the central station. He admitted that some official of a public-utility company sometimes takes the wrong position, which causes antagonism on the part of a certain portion of the public. This, of course, is to be regretted and must be remedied as far as possible and the attitude of the company should be to placate the small customer, as it is usually with him that the dissatisfaction arises. There is usually no trouble in the relations with the large consumers. By having harmonious relations with the contractors he considered that each one of them was in a manner an agent and advertiser for the central station. He explained that the exhibition room originally started by the company had developed into a shop through necessity, but that prices

were maintained except in very exceptional cases when special sales had been carried on temporarily. One of these had been in the case of flatirons and had resulted in disposing of a large number of these. His company maintains an installation bureau for handling large jobs requiring quick service, which it had found the contractors could not handle satisfactorily, but regular contracting work is not done by the company.

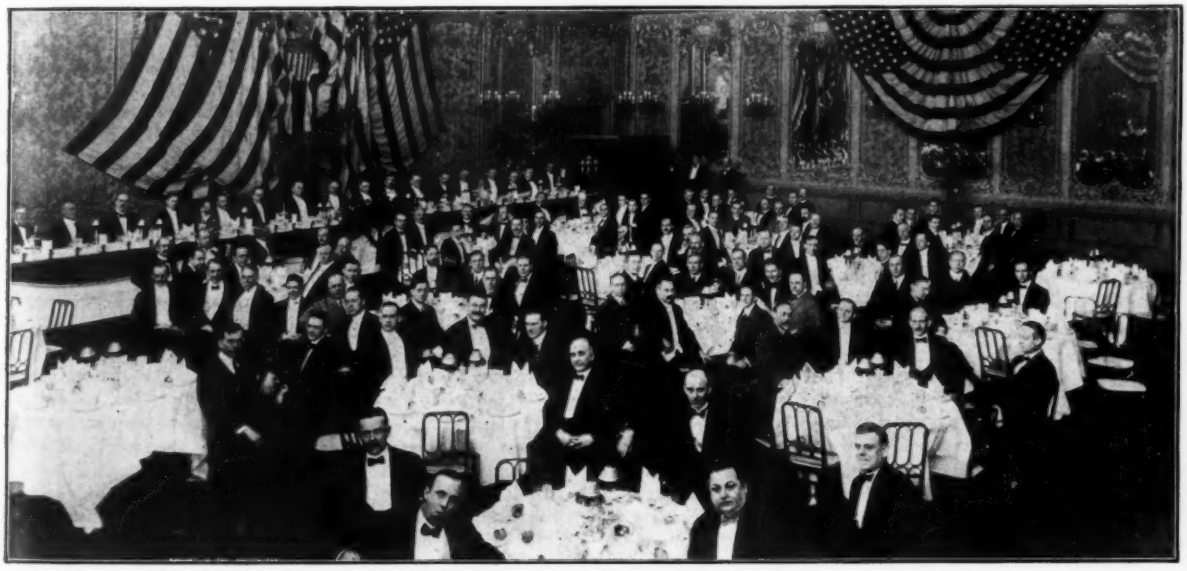
Mr. Stone said that the manufacturer is anxious for co-operation in the marketing of his products. Since the central-station men, although a highly specialized class, are not necessarily merchants, he considered that the dealers and jobbers had a very definite place in the development of the electrical business. He pointed out that certain apparatus for general use, such as washing machines, is too expensive to be introduced readily and requires considerable pushing. It is necessary to see that such apparatus is properly installed and properly used, and whether the apparatus is sold by the dealer or the central station there should be a system of follow up, which would take care of burnouts, etc., and insure that switches and other apparatus was properly looked after. The manufacturer cannot do this kind of work and it is very necessary that either the dealer or the central station should carry out such systematic inspection. It is seldom that the dealer does this, as he has usually very little interest in the matter after the sale. On the other hand, the central station is interested in the continued satisfaction of electrical service and is more likely to make use of such follow-up methods. He stated that the manufacturer was anxious to have the co-operation of both the central station and the dealer with regard to the development of new apparatus. The manufacturer needs help in his research work along the line of knowing what the demand of the public is, or what demand can be created for new apparatus.

Mr. Strong stated that the attitude of the contractor was very similar to that of the jobber. He wanted harmony and such a condition as will enable him to do business at a profit. The creation of proper merchandising conditions, as pointed out by Mr. Robertson, was a very real need. He thought that the co-operation of the central stations usually extended to the point where it suited their convenience, and it was, consequently, a much misused term. Real co-operation exists only when something is given up on either side. He said that all the contractors asked for were reasonable and decent business conditions, and he pointed out the reason why dealers did not push sales of electrical devices generally. He thought the manufacturers were partly at fault in this matter, as they often sell directly to the consumer and sometimes make a better price to a large consumer than to the middleman. The spirit of the Society should be on the basis of doing business at a profit. As it is, the middleman is in a very hard position, since his importance is small compared with that of the manufacturer and central station. He thought that the Society should work for harmony locally, in which case the dealer's importance would increase. He referred to an address which he had made before the National Electric Light Association in 1906, when he was president of the National Electrical Contractors' Association, with respect to the central station giving away devices and wiring. He thought much had been accomplished since that time in doing away with these practices.

The discussion was continued by Max Lowenthal, H. E. Woodill, C. G. Durfee, H. K. Mohr, W. H. Weeks and James I. Ayer.

Mr. Lowenthal called attention to the varied experiences which he had had as editor, dealer, jobber, engineeer, manufacturer and central-station representative, and indicated that the various interests represented in the Society could never be expected to agree. It was not an electrical problem that was involved, but a human problem —the problem of the merchant. He spoke of the development of the department store and the impossibility of controlling prices there. The department stores were now taking up the sale of electrical devices and it would be visionary to expect to maintain control over the prices at which these were sold. The only way to accomplish anything in competition with them was to teach the salesman how to compete upon the same basis. This will usually be a local problem. He advocated instruction in window dressing, and other elements of salesmanship, with lectures, exhibitions and similar activities to stimulate the interest of the public.

Mr. Woodill, who is a dealer in Los Angeles, Cal., stated that his company advertised regularly and also took care of the equipment after installation. They used central-station methods so far as the follow-up is involved and used the department-store methods in



Banquet of Society for Electrical Development.

disposing of goods. He spoke of the difficulty to which they had been subjected by the fact that the Southern California Edison Company habitually cut prices of electrical devices below cost, but nevertheless his company had been able to establish a business which is still growing.

Mr. Mohr inquired whether it would be satisfactory to the dealers and contractors if the central station maintained prices although still dealing in electrical apliances. Mr. Robertson later answered this question by saying that they would be satisfied under such conditions.

Mr. Durfee, of the Rochester Railway & Light Company, stated that in many places the interests have not known how to co-operate. The central station in Rochester ceased all wiring and selling some years ago and offered its show-window space to the dealers, and yet mistakes were unwittingly made, which caused friction. Since the practice has been adopted of having regular dinners attended by contractors and central-station men, the trouble has largely vanished.

Mr. Weeks, who is a lamp salesman in Southern territory, spoke of the lack of co-operation by all hands, even where an effort for it had been made by the central station and some of the contractors. He gave an illustration showing how a contractor had taken advantage of the effort of the central station to co-operate, to the advantage of the latter.

Mr. Ayer spoke of the difficulty arising from the fact that the different interests involved in the question of co-operation were often unacquainted with each other, and of the advantage of weekly lunch clubs in doing away with this condition. He told how the central station in Boston had established a show room for dealers but had found it necessary to sell devices as well, and had gradually come to the point of selling for itself. Selling, however, was done at retail prices. At the present time the dealers in that city are advertising and sell about two-thirds of the entire product, which experience points to the possibility for co-operation and real merchandising.

Chairman Doherty then expressed the greetings of the meeting to Miss Harriet K. Billings, assistant secretary of the National Electric Light Association, who was present at this session, and referred to her as one of the first co-operators.

Mr. Robertson, in closing the discussion, stated that the different elements in the electrical field were getting closer together and he regarded conditions satisfactory in Philadelphia, Boston, Cleveland and other cities, where a real effort had been made in this direction. He stated the fundamental condition to a solution of the problem was that real merchandising could not be done with cut prices. He stated that the middleman would always exist, and represented a very stable class.

Electrical Advertising.

William D. McJunkin then presented a paper entitled "An Electrical Advertising Campaign," in which he presented his views of the problem of national electrical advertising along lines which would attain the objects of the Society for Electrical Development. His study of the problem was represented by a large chart which showed a layout of the field to be covered, and he went into a discussion of the advertising mediums which it would be advisable to use in order to properly reach the desired elements of the public. The field of electric service was classified under the heads of "Home," "Business," "Municipal," and "Festival." He considered newspapers impracticable for a national campaign and discussed the weeklies, monthlies, reviews and class publications which should be used, the arguments which should be presented for light, heating and power, and the style of copy which would be best suited to the ends in view. He favored the adoption of some device by the Society and also a slogan to appear in every advertisement. This would help the continuity of impression. He also favored the use of moving pictures and the publication of a number of booklets dealing with the use of electricity in the home, the office, the store, the shop, etc. He also favored the publication of a monthly house organ by the Society.

In the discussion, W. J. Clark, of the General Electric Company, pointed out the omission of the electric railway as one very large element in the electrical consumption of the nation.

J. M. Wakeman, general manager of the Society, anounced that the Executive Committee would begin on the following day to digest all the excellent ideas which had been proposed and discussed in the conference, and that it expected to arrive at some definite program for the activities of the Society.

Several moving pictures were then exhibited through the courtesy of J. C. McQuiston, of the Westinghouse Electric & Manufacturing Company. The films used were supplied partly by that company and partly by the General Electric Company and the Commonwealth Edison Company.

The conference closed with a banquet on Wednesday evening at Delmonico's, at which T. C. Martin acted as toastmaster. The first speaker called upon was Don C. Seitz, business manager of the *New York World*, who stated that the newspaper which he represented was a large consumer of electricity, its annual account with the New York Edison Company amounting to $96,000.

Mr. Wakeman read a message from Charles A. Coffin, president of the General Electric Company, expressing his interest in the objects of the Society and his inability to be present. A. W. Burchard, vice-president of the company, responded to a toast pointing out the attitude of the public to industrial consolidation at the present time, and the opportunities of the Society for pursuing its objects through the consolidation of the electrical interests in a way which would not arouse any such antagonism.

Guy E. Tripp, of the Westinghouse Electric & Manufacturing Company, and W. A. Layman, of the Wagner Electric Manufacturing Company, also responded, expressing their adherence to the objects of the Society.

F. E. Watts, Jupiter of the Jovian Order, was then called upon and made a long address pointing out the objects of the Order and the change which has lately taken place in its aims and purposes. It was devoting itself largely to local co-operation through the medium of weekly luncheon clubs, and he believed the Society would find all of these excellent adjuncts in its campaign for co-operation.

Louis Wiley of the *New York Times* was the next speaker and was followed by F. M. Tait, president of the National Electric Light Association, who expressed his determination to enlist the aid of the member companies of that association in the work of the Society.

Hugh M. Wilson, vice-president of the McGraw Publishing Company, was then called upon to represent the technical press. He emphasized the aid which the electrical journals had been to the industry in the past and expressed their readiness to lead the movement towards greater commercial development.

The closing speech was made by President Doherty, who proposed that a telegram be sent to the President of the United States expressing the good wishes of the Society and pointing out that it had been launched upon its way upon the same date as the new federal administration. Telegrams were also sent to Thomas A. Edison, Charles F. Brush and J. Robert Crouse, expressing the appreciation of the members present of their interest in the objects of the Society and sending the greetings of those present.

The speeches were interspersed from time to time with vocal solos by William E. Robertson, the entire assemblage joining in the choruses of his well rendered songs.

New Electrical and Mechanical Appliances

The Foen Electric Hair Drier and Hot-Air Douche.

A new and very useful electrical appliance for producing conveniently a concentrated hot-air or cold-air breeze has recently been put on the American market under the trade name Fön or Foen. It was developed in Germany several years ago under the direction of Dr. A. Frey and many thousands of the appliances are now in successful use. Among the many uses are for drying hair, gloves, handkerchiefs, photographic plates, ink rollers, etc.; for warming beds, towels, infants' wear; for cosmetic treatment and beauty culture; for treatment of rheumatism, gout, lumbago and other ailments; for puffing feathers, furs, etc. Thus they have been found serviceable not only in barber and hair-dressing establishments, but in the boudoir and bath room at home and in a variety of industries.

The Foen appliance is a very compact outfit consisting of a small but powerful motor driving a centrifugal

Hair Drier and Hot-Air Douche.

blower. This draws air in at the perforated side and blows it through the tangential tube. In this is a fine-wire heating coil wound round a porcelain tube arranged so that no part of it can become overheated. The air current can be regulated by two small interchangeable tubes with different sized openings. The heating unit and these tubes can be changed in a few seconds without tools. In the construction of the outfit aluminum is used as much as possible. This makes it light in weight and therefore easy to handle without fatigue; its weight complete is 950 grams or about two pounds.

The apparatus can be supplied for either direct current or alternating current and for whatever voltage may be desired. Taking but a small current it can be connected to any lighting socket. Its cost of operation is two cents or less per hour. A single switch is used on the outfit; on the first turn it starts the motor and blower, furnishing a cold blast which is useful in place of ice packings and cold compresses; the second turn of the switch supplies current to the heating element also, thus giving the hot-air drying or douche effect.

The Sanax Company, 125 East Twenty-third Street, New York City, is the American importer of the Foen appliance. The Canadian importer is the Canada Sanax Company, Limited, 34 Victoria Street, Toronto, Ont.

Rotometer.

In determining the length of an electric circuit from drawings and plans the use of a rotometer or map measure will be found very convenient. This instrument is put on the market in a watch pattern by Eugene Dietzgen

Rotometer or Map Measure.

Company, Chicago, Ill. The dial has two graduations, one representing 12 inches in eighths, and the other 25 feet, marked for each foot.

To measure the length of a line the instrument is first set to read zero and then, holding it vertically, the line is gradually followed in one continuous direction with the small projecting tracer wheel. The length of the line will then be indicated by the index hands on the dial.

Wireless Telegraph for Lackawanna Railroad Trains.

According to newspaper accounts officials of the Lackawanna Railroad expect that within a few weeks wireless service to and from trains will be in operation between Scranton, Pa., and Binghamton, N. Y. An improved system is to be used. Plans for two stations have been completed and work of construction will be commenced at once. If proven successful, practically every station and train on the Lackawanna line will be so equipped.

Although previous attempts of this kind have been unsuccessful, the latest innovation, officials say, is one of the most far reaching in the matter of possibilities ever attempted by any railroad. It indicates not only increased safety in the matter of the movement of the trains, but added comfort and convenience to passengers. In approaching a station it will be possible for a conductor to communicate instructions to the station agent, and, on the other hand, news may be transmitted to the passengers. The great difficulties with wires during storms will also be eliminated.

Benjamin Socket Extension for Unskirted-Base Mazda Lamps.

Lamp manufacturers are now furnishing the 60-watt Mazda lamp with unskirted medium screw base. The dis-

Socket Extension.

tance from the base contact to the center of the filament has thus been shortened approximately an inch and the proper relation between filament and most reflectors accordingly destroyed.

The Benjamin socket extension listed as No. 91 by the Benjamin Electric Manufacturing Company, Chicago, Ill., meets this condition by lengthening the sockets just enough to overcome the defect involved. The new lamp can thus be used to give proper lighting results without a change of reflector.

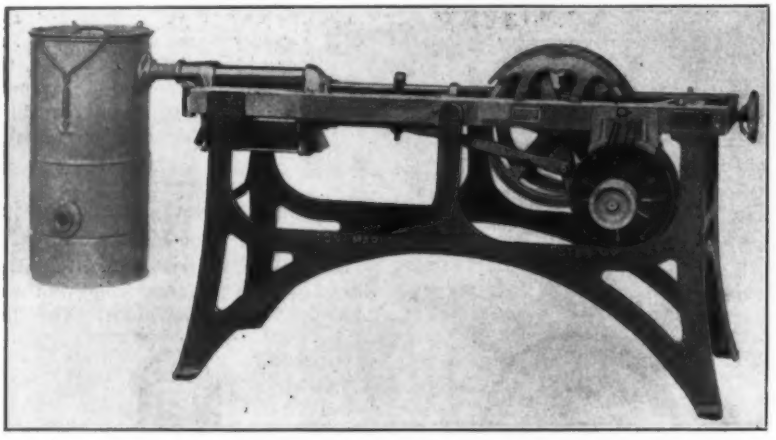
Other changes that can be made are from 60-watt skirted-base Mazda to 40-watt Mazda; 40-watt to 10, 15 or 20-watt Mazda; 100-watt Gem to 25-watt Mazda; 50-watt Gem to 10, 15 or 20-watt Mazda.

A Stationary Suction Cleaner With a Multi-Duty Motor.

The usefulness of the small electric motor for doing many of the hard, disagreeable tasks around the home has become so well recognized that one suction-cleaner manufacturer has designed his machine so that full advantage can be taken of the motor's power when the cleaner is not in use.

The illustration shows the cleaner (which is known as the Multi-Duty) with a Westinghouse motor. When the motor is driving the cleaner, a pinion on the inner end of the motor shaft meshes with the large gear wheel, which operates the air pump through a connecting rod. To make the motor available for other purposes the handwheel on the end of the cleaner frame is turned; this draws the motor forward and disengages the pinion; a pulley on the outer end of the motor shaft provides means for belt drive.

As a cleaner, the outfit is very efficient and satisfactory. The suction



Suction Cleaner and Multi-Duty Motor.

pipe is attached to the lower end of the dust receptacle and runs through the house with outlets on each floor to which the hose with the cleaning tool is attached. The motor can be stopped and started from any floor by means of switches.

As an independent source of power, the motor can be used for many purposes. It can be belted to a lineshaft from which various machines can be driven, or it can drive separate machines directly. Washing machines, wringers, ironing machines, ice-cream freezers, polishing wheels for metalware, grinding wheels for sharpening knives and small tools and for grinding metal, water pumps, air pumps for inflating automobile tires, small machine tools for the workshop, and many other devices can be operated in this way.

Thus power is available whenever it is wanted. The householder who uses it finds it of the greatest convenience and is often able to save considerable in servants' wages. The cleaner is manufactured by the Clayton-Marlborough Manufacturing Company, Rochester, N. Y. Westinghouse small motors are used.

Optimus Plastic Alloy for Copper Joints.

The ground and polished surface of a copper busbar, though apparently smooth and regular, exhibits numerous peaks and valleys when viewed under a microscope magnifying it no more than 50 diameters, says *Industrial Engineering*. When two of these bars are placed face to face, they touch each other only at the high points, and the current, instead of having the entire surface of contact through which to flow, is compelled to concentrate at the comparatively few peaks which touch, thus making the resistance of the joint relatively very high. Even though considerable pressure be applied, the valleys will not be forced up into contact, and moisture will creep in and eventually coat the surfaces with a non-conducting oxide.

A well made busbar joint carrying 1,760 amperes, when tested in a French laboratory, showed a drop of 0.048 volt, or a loss of 84.48 watts. In a plant operating 10 hours a day and 300 days in the year, the annual loss at such a joint would be 253 kilowatt-hours, or, at 10 cents per kilowatt-hour, $25.30.

In order to reduce the losses due to defective contacts, the Munning-Loeb Company, of Matawan, N. J., has brought out a metalliferous putty-like substance under the trade name of Optimus Plastic Alloy. This paste when placed between the copper surfaces of a joint fills up the minute depressions, adheres tightly and, it is stated, reduces the contact resistance over 90 per cent.

It is the usual practice to allow one square inch of copper contact surface for each 50 amperes of current flowing through busbar joints, switches, ammeter shunts, etc. When the Optimus alloy is used, it is claimed that 1,000 amperes per square inch can be allowed to flow through a joint, that the loss at the joint will be but little more than that in a continuous conductor of the same cross-section, and that, if properly made, the joints will remain in perfect condition for years.

This alloy is now being extensively used in electroplating plants, where, on account of the heavy currents used, the I^2R losses are apt to be large, if the joints are not made in the best possible manner.

Electric Goods Display Stand.

The Rochester Stamping Company, Rochester, N. Y., which manufactures the well known Royal-Rochester line of electric household appliances, has just brought out a very practical display stand for showing this line of electric goods. It measures about 56 inches in height, and is made of steel castings sufficiently heavy so that it will not tip over. It is beautifully finished in aluminum, and accommodates nine articles. By a simple screw arrangement the goods are fastened on the brackets so that they can not be knocked off, but are readily released by a twist of the thumb. It is a decidedly handsome fixture and a splendid thing for displaying this ware to good advantage.

Rochester Display Stand.

Colorado produced 7,025,000 pounds of copper in 1912, a decrease from 1911 of 1,000,000 pounds.

Operating Air-Break High-Tension Switches Under Severe Winter Conditions.

The rapid development of high-tension weatherproof protective and control equipment and the requirements of local conditions has resulted in several distinct types now being tested under actual operating conditions. One of the most difficult tests, however, to secure with high-tension air-break switches, is to determine the effect of sleet or ice. Severe sleet storms are rather infrequent and when they do occur it is often difficult for the switch manufacturer to get on the scene in time to secure essential data. The obvious thing to do, therefore, is to duplicate as nearly as possible the effects of a severe sleet storm as affecting the switch operation and the accompanying illustration shows a switch used in the test here described.

This switch is of the three-pole, PM type, manufactured by the Delta-Star Electric Company, Chicago, Ill., and is mounted on a temporary four-pole structure, although in actual service installations but two poles are necessary. With a temperature of 25 degrees above zero and a wind velocity of 25 miles an hour, as recorded by the United States Weather Bureau, a heavy spray of water was directed on the switch for approximately 2.5 hours. The ice deposit secured was very heavy and resulted in many long icicles extending from the insulator petticoats to the channel-iron switch mounting. The operating mechanism connecting the three rotating switch arms is located within the central channel-iron mounting base and therefore was not affected by the ice formation, only the exposed elements being coated as shown.

Under the conditions illustrated in Fig. 1, the flash-over occurred at potentials from approximately 51,000 to 57,000 volts. This value was somewhat variable due to the fact that as the voltage was raised and leakage began, the icicles would begin to melt and stream. During the test a spray of water was kept playing on the switch, thus keeping the ice wet. The combination of ice formation, streaming icicles and steady water drizzle was probably equal to the worst winter conditions and the result secured will undoubtedly form the basis for many important developments in high-tension switches during this year.

After the breakdown or voltage tests were completed the switches were operated by closing and opening the swinging arms, thus breaking the ice at both main and auxiliary contacts.

Fig. 2 shows the action of the main and arcing contacts. It will be seen that the main contact has opened, the arcing contacts still remaining in circuit and in position to take the arcing or burning incident to final opening.

Obviously, the problems of carrying capacities, voltage breakdowns, clearances, etc., are relatively simple, as these simply depend on spacing, size of contacts and the type of insulator used. The real problem in outdoor switches is to adopt a construction which will meet the conditions as presented by severe winter conditions. Additional tests on this type of switch will be conducted in the near future and the results obtained used in further developments now under way.

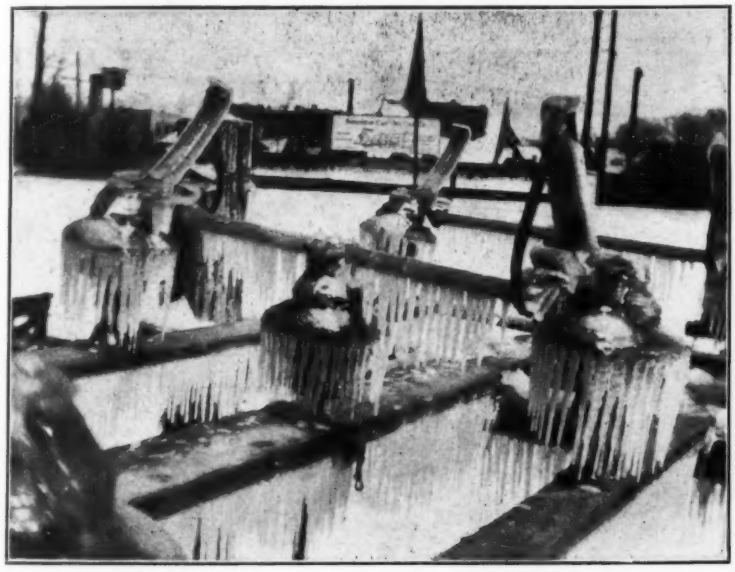


Fig. 1.—Sleet Test of Two Poles of a Three-Pole Air-Break Switch.

Fig. 2.—Action of Main and Arcing Contacts.

Electrical Exhibitors at Woman's Exposition at Cleveland.

During the week beginning February 24 there was held in the Central Armory at Cleveland, O., the American Woman's Exposition. Some six different classes of exhibits were comprised therein, dealing with a variety of household, fashion, health and beauty interests that appeal to all ladies. The exhibition was very well attended by the women of Cleveland and surrounding places.

Among the exhibits were many displays of electrical appliances particularly designed for alleviating household conditions. The exhibitors of these electrical devices were the following:

Enterprise Electric Company; washing machines, mangles, electric fixtures and heating devices.

Erner Electric Company; full line of electric household devices.

Eureka Vacuum Cleaner Company; vacuum cleaners and vibrators.

Fitch Electric Company; electrical fixtures and heating devices.

Hoover Suction Sweeper Company; electric suction sweepers.

Maytag Company; electric washing and wringing machines.

Monarch Electric Supply Company; electric toasters and sterilizers.

Monarch Vacuum Cleaner Company; electrically driven vacuum cleaners.

Peerless Lamp Works of General Electric Company; complete display of Mazda lamps.

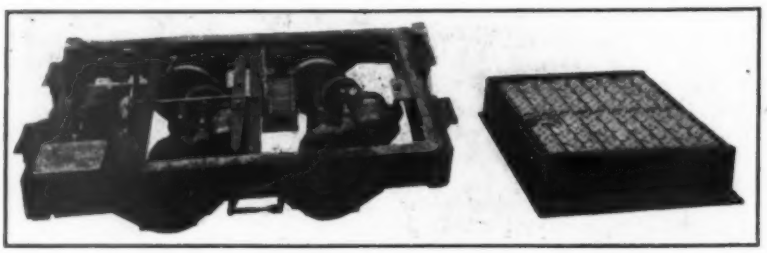
The Cleveland Electric Illuminating Company, while making no exhibit, maintained reception headquarters, at which the numerous advantages of the use of electricity in the household were explained to the many visitors.

Storage-Battery Haulage Locomotive for Gathering Work in Mines.

A novel and at the same time one of the latest applications of the storage-battery haulage locomotive is gathering work in coal mines. One of these machines manufactured by the General Electric Company was recently installed in the Glendower Colliery of the Philadelphia & Reading Coal & Iron Company. The locomotive is designed specially for the service and also built for hauling six trailers.

Electric locomotives of both the storage-battery and overhead-trolley types, designed for carrying the load as well as hauling loaded trailers, have been employed very advantageously for industrial service. Comparatively recently a number of machines of the storage-battery haulage type were also introduced and have operated very successfully in the work of excavating the Catskill Aqueduct Tunnel in New York. In general, locomotives of this latter type are designed specifically for short-distance hauls at moderate speeds where it is not feasible to install the overhead-trolley system. Under these conditions, the storage-battery machine has proved to be both economical and well adapted for the purpose.

The locomotive for service in the Glendower Colliery is equipped with two 85-volt motors and controller. The batteries employed are of the A-8 Edison type; each has 70 cells and a capacity of 300 ampere-hours with a discharge rate of 60 amperes for five hours. They provide, at the full rated drawbar pull and speed, for a run of nine miles on one charge of the batteries. Under an assumed car and track friction of 30 pounds per ton on level track, this rating is equivalent to 300 ton-miles on one charge. The machine is fitted with the usual ampere-hour meter indicating the amount of charge and discharge, headlight and gong.



Battery Box Removed to Show Running Gear.

The locomotive is built to conform to the following specifications: Total weight, 8,000 pounds; length overall, 8 feet, 9 inches; width overall, 5 feet, 3 inches; height over platform, 2 feet, 4 inches; height over battery compartment, 3 feet, 9 inches; wheel base, 44 inches; diameter wheels, 20 inches; track gauge, 44 inches; rated drawbar pull, 1,000 pounds; speed at rated drawbar pull, 3.5 miles per hour.

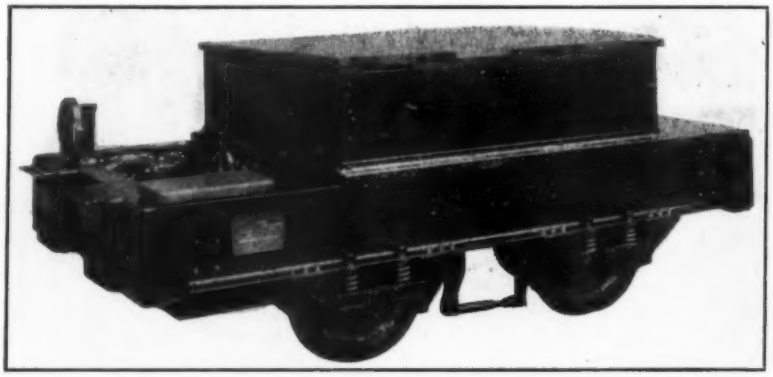
The batteries are designed for the particular service, are of rugged construction and the plates are made specially to give the high service efficiency. The cells are grouped in 18 trays and are mounted on top of the locomotive frame in a wooden case.

The mechanical design of the machine is in accordance with the latest modern practice. The frame consists of steel channel sides and steel plate ends carefully fitted at the joints and held together rigidly by bolts and steel angles. The end plates are faced with wooden bumpers, to which suitable couplers are attached. A seat for the operator is provided in the rear. The cast-steel pedestal jaws, which carry the journal boxes, are securely bolted to the lower web of the channel side frames. The cast-steel journal boxes are of a special design and are fitted with roller bearings, which assures efficient mechanical transmission of power and consequent economy of battery-current consumption.

Brake tension is effected by means of a square threaded brake spindle. A square threaded nut travels on the spindle and carries an equalizing bar, to the ends of which are connected chains leading from the brake levers. This device admits of locking the brakes automatically, without the use of pawls or ratchets, in any position left by the operator.

The controller is of the drum type and built for this particular class of work. The mechanism is inclosed in a malleable-iron case, which is provided with removable sheet-steel covers.

The motors are series wound, inclosed and of the familiar automobile type. They are designed especially to operate from batteries and have characteristics that effect the maxium possible economy in the use of battery current. They have high efficiency, large overload capacity and operate with practically sparkless commutation. High efficiency is obtained by designing them with a small air gap and running the iron at low densities. By reason of the latter provision, the speed and torque characteristics are steeper than in the ordinary series motor, thereby tending to limit the overload which can be thrown on the batteries.



Storage-Battery Colliery Locomotive.

The armature shaft rotates in ball bearings. Friction losses are therefore very slight and the bearing wear is practically nil. Although compactly designed, the motors are nevertheless readily accessible for inspection and repair. Being of the inclosed type, they are dustproof and moistureproof. One motor is mounted on each axle in a cast-steel suspension cradle, one side being supported on the axle bearings and the other side spring-suspended from the locomotive frame, in accordance with standard practice.

The motors drive the axles through double-reduction gearing, an intermediate shaft, supported in the bearing housing cast integral with the suspension cradle, carrying the intermediate gearing. As slow-speed service is ordinarily required of a storage-battery locomotive, the use of double-reduction gearing affords such speeds with minimum rheostatic losses; and due to the large gear ratio from armature shaft to wheel tread, very high tractive efforts are obtained at comparatively small current inputs to the motors.

Motorcycle With Pyrene Extinguisher as Auxiliary for Fire Departments.

A prominent manufacturer of motor cycles has been considering the market for its product among fire departments as a valuable aid to standard fire apparatus. It decided after these investigations that a motorcycle, if equipped with an efficient, small and easily operated hand extinguisher could get to the scene of a fire several minutes before the heavier apparatus. As "all fires are of the same size at the start"— that is, small—there is little question but that much loss would be averted by the prompt use of a hand extinguisher.

The Harley-Davidson Motor Company, of Milwaukee, Wis., in co-operation with the Pyrene Manufacturing Company, of New York City, manufacturer of the well known Pyrene fire extinguisher, is bringing the matter to the attention of the fire-department chiefs throughout the country. It has been demonstrated that three Pyrene fire extinguishers could be carried on a motorcycle without any inconvenience; thus, if it were necessary, two occupants of the building could use Pyrene instantly and the third extinguisher could be used by the motorcyclist.

The Pyrene fire extinguisher is admirably adapted for this purpose on account of its small size and high efficiency on all classes of fires including electrical. The Pyrene extinguisher is three inches in diameter and only fourteen inches long. It employs a double-acting pump which insures absolute certainty of operation. The extinguishing compound, Pyrene, is generally believed to be the most efficient fire extinguisher known to science. It is a compound of powerful gases in liquid form and when subjected to a temperature of 200 degrees Fahrenheit or over, is instantly transformed into a heavy, dry, cohering, non-poisonous and non-inflammable gas blanket, which surrounds the flames and smothers them. Pyrene is especially effective on fires having their origin in highly inflammable materials such as gasoline, benzine, lacquers, oily waste, etc.

For fires in electrical equipment, Pyrene may be used with perfect safety to the operator and with no resulting damage to the equipment. Pyrene liquid may be directed between the commutator and brushes or the armature and field of any moving rotary machine without in any way causing damage to the apparatus or injuring the operator, irrespective of voltage used. This applies as well to controller boxes, rheostats, transformers, switchboards and all other electrical equipment. Pyrene will break an arc caused by short-circuit, and when broken, the arc will not re-establish itself.

The resistance of Pyrene liquid is 30,000 megohms per cubic inch. Its dielectric strength is 13,240 volts per one-tenth inch. Owing to its extremely high resistance, Pyrene will always be serviceable on the highest voltages commercially used and on all classes of electrical equipment.

Brass and nickel-plated Pyrene fire extinguishers are the only one-quart fire extinguishers included in the lists of approved fire appliances issued by the National Board of Fire Underwriters.

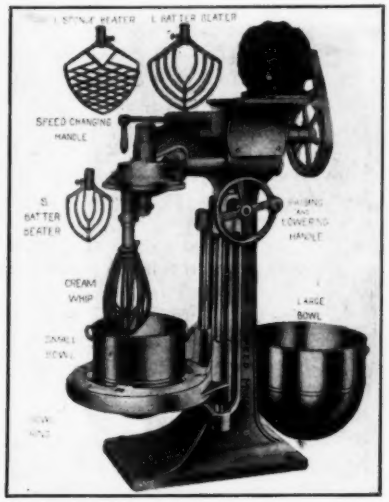
Motorcycle Equipped with Pyrene Fire Extinguishers as High-Speed First Aid to Fire Department.

Motor-Driven Mixer and Beater.

The use of machines driven by small individual electric motors has proved a great source of economy in bakeries, confectionery plants, hotels, and restaurants. These machines do their work much more rapidly than it can be done by hand, and produce better and more uniform results at an insignificant expense for current. Hence the cost of labor is greatly reduced, the work can be put through with less delays, and working conditions in the kitchen or bakery are greatly improved by reducing the number of people employed in it and lessening the amount of material standing around and spilled.

Motor-driven machines of all kinds can be obtained; egg and cake beaters, dough mixers, dish washers, knife grinders, silverware polishers, vegetable parers, fruit pitters, etc. The beater and mixer illustrated herewith is a typical example of these time and labor-saving devices and gives an excellent idea of what can be accomplished by them.

This machine is applicable to all classes of plain and fancy cake, biscuit, and egg work, fruit and other pie fillers, jams, jellies, sauces, dressings and other preparations that require mixing and mashing.



Mixer and Beater with Various Attachments.

The beating bowl rests on a stand which can be raised to the beater by turning a handle. When the operation is completed, the bowl is lowered and another substituted. A variety of styles and sizes of paddles, such as beaters for sponge, batter, eggs, cream, fruit, pumpkin, cheese cakes, and potatoes can be supplied for the machine; and, since one can be quickly replaced by another, the operation of the machine can be made practically continuous regardless of the kind of work to be done.

The machine has three speeds, any one of which can be obtained by turning a handle without stopping the machine. The capacities of the bowls which are supplied with the machine are 30 and 80 quarts. Where the mixture to be beaten must be kept hot or ice cold, a water bath is supplied.

The machines are made by the Read Machinery Company, York, Pa. Westinghouse motors are used to drive them.

Earthing the Neutral Point on Three-Phase Systems.

The importance of earthing the neutral point on a three-phase system has been to a very considerable extent fully appreciated during the past few years, especially where such systems are of an extensive nature and involve large power capacities of plant. In the earlier days when the units employed were small and the distances traversed by the cables were not extensive, it was thought by some that earthing the neutral point was not altogether advisable, as if such earthing were not used it would be possible to run the system for a short time even with an earth on one phase. It was, however, soon found that an earth on one phase developed fairly rapidly into a short-circuit between phases with the result that probably a section of the cable was burnt off, damage often resulting to adjacent cables, while in many cases, especially with extended systems, surges of pressure were set up which led to a breakdown of insulation elsewhere, even when such insulation under normal circumstances was perfectly well capable of standing up to the normal work required. The practice is therefore now practically standard of earthing the generator neutral, and in this way a fault to earth on any part of the system immediately leads to the faulty portion being cut off with the minimum of disturbance to the rest of the system. Inasmuch as the majority of troubles on three-phase alternating systems of supply, especially at high tension, are indicated or accompanied by earths, it is comparatively easy to devise systems of protection, given an earth and neutral.

There is, however, an important point to be remembered in connection with the earthing of the neutral point, especially on larger systems, as pointed out by J. S. Peck in his paper on "Earthed versus Unearthed Neutrals on Alternating-Current Systems", in the issue of December 21, 1912. This is that the neutral point should always be earthed through a resistance which will limit the rush of current to earth to a predetermined value in the event of a fault, both with a view to preventing damage and also from the point of view of avoiding surges of pressure in the system. It is, however, easier to state a case for such earthing resistances than it is to devise a suitable resistance for the purpose, especially when the values of energy to be dealt with are at all large. Iron-grid resistances have been tried for the purpose, but when mounted upon porcelain insulators are liable to breakage, failure of insulation and similar damage where the discharges through the resistances are at all prolonged. A very ingenious and practical solution of the difficulty has, however, been devised by Mr. Brazil of the Charing Cross, West End & City Electricity Company, Limited, one of the largest London electricity supply organizations, and this consists of a series of powder resistances suitably mounted, which have been found to be free from many of the troubles hitherto discovered in resistances. They occupy a very small space, as a resistance capable of absorbing 100 kilowatts only measures about 22 by 18 by 8 inches. They possess a negative temperature coefficient, that is to say, the resistance falls as the current passes through the resistance. The current therefore never rises above the value which is just sufficient to open the circuit-breaker, thus subjecting the system to the minimum of shock. With the ordinary iron grid the reverse takes place, so that the resistance has to be made extremely low to allow for the possibility of the breaker not opening instantly, which means that an abnormally heavy current has to be broken. The initial current in fact in the case of the Brazil resistance need not be more than 30 per cent of that necessary with the iron grid to provide the same protection. The importance of this can be seen when it is remembered that the setting up of the surge on the system depends almost entirely on the value of the current broken. Each unit is complete in itself, so that if, as not infrequently occurs, it is subsequently desired to alter the value of the earth resistance, this is very readily done by altering the number of units by merely regrouping them or even by varying the quantity of the power used. In one case, a resistance which was originally required to pass 200 amperes at 6,000 volts, was altered because owing to a rearrangement of the feeders, the current taken had to be reduced to 50 amperes, and to do this it was only necessary to alter the original grouping of the units, namely, 8 in parallel and 9 in series, to 4 in parallel and 18 in series.

As regards the method of connection, the question still remains of whether the generator neutrals should be earthed each through its own resistance or to a common bar, the latter being connected to earth through a resistance. This second arrangement is considered by the makers of the apparatus, Everett, Edgcombe & Company, Limited, of Hendon, London, to be by far the best, since no matter how many generators may be running in parallel, the resistance to earth remains always the same. The objection urged to this method of connection is that in certain cases a comparatively large current may circulate between the machines, due to a triple-frequency harmonic in the wave form. As pointed out by Mr. Peck, the evil effects of the triple frequency current have been considerably exaggerated in the past, and even in an extreme case in which the current in the neutral was equal to the full-load current, the additional heating of the generators due to this cause is only about 11 per cent. It would therefore appear better to start with the neutrals solidly connected to the earthing bar, the latter being earthed through a resistance. Should the circulating current prove excessive, a few Brazil units can be inserted between each neutral point and the bar and in the majority of cases this can be done by merely regrouping the earthing resistance itself. The experience of the makers goes to show that in many stations where each machine is provided with an isolating switch, so that when several are working in parallel on the bars only one is connected to earth, it frequently happens that more than one is accidentally left on without any evil results ensuing; in fact, it is often not found out for some time that this has been done. In view of these arguments the method of connection to a common bar appears to be desirable.

Although at first sight the development of this special form of resistance appears to be an improvement of a secondary nature, a little consideration will show that it is really of fundamental importance. The value of an earthed-neutral system is dependent on absolute reliance being possible on an effective connection to earth at all times. Should the confidence in the presence of an earthed neutral be mistaken even for only a short period, there is no doubt that the way would at once be opened to accident of a very serious nature, and it therefore follows that whatever apparatus is used for earthing of the neutral his must be absolutely reliable.

Storage-Battery Car Runs from New York to Boston in Seven Hours.

An electric car, equipped with Edison storage batteries, which will be put in operation on the Newton Lower Falls Branch of the Boston & Albany Railroad, arrived in Boston at 4 a. m., March 7, after a successful experimental run of seven hours from New York, where it was built. The railroad has decided to put this new car in commission for some time in order to test the efficiency of the battery for traction purposes.

The car, which is about 50 feet in length, is divided into two compartments, one of which, for passenger service only, will accommodate 40 persons. The other is provided with sliding doors for baggage, and has seats for 12 passengers along the sides.

The battery is located in compartments suspended under the main body of the vehicle. The wheels are free on the axles and rotate separately, the motor being connected to each wheel by a chain. The weight of the entire car is 56,700 pounds.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

MOTT, N. D.—C. J. Lee, of Valley City, is considering the erection of an electric light plant here. Z.

OAKDALE, CAL.—The Sierra Power Company is contemplating rebuilding its distributing system in this city.

SILVIS, ILL.—The Village Board will replace the arc lights now used for lighting the streets with tungstens. Z.

ROCKWELL, IOWA.—C. C. Carhart, of Sheffield, will build a transmission line from Sheffield to Rockwell, a distance of six miles. Z.

BOISE, IDAHO.—The City Council will receive separate bids for the installation of arc lights, covering materials and labor. O.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company has voted to increase its capital stock $2,000,000 for enlarging the system. S.

NAPERVILLE, ILL.—The Dupage County Electric Light & Power Company has been granted a ten-year franchise to supply electricity in Naperville. Z.

CANTON, ILL.—The Canton Gas & Electric Company is contemplating building a transmission line to Lewistown to supply electricity for commercial purposes. Z.

HASTINGS, MICH.—Thornapple Gas & Electric Company has announced its intention to spend about $16,000 in improvements in the plant here and at Middleville this season.

PHILADELPHIA, PA.—The Thompson Electric Company has been incorporated under the State laws of Pennsylvania for $20,000, to operate in and around Lancaster, Pa. N.

TULARE, CAL.—The San Joaquin Light & Power Company will begin work shortly on an additional power line connecting the Strathmore substation with the substation at Famosa.

ELGIN, ILL.—The City Council plans to secure an electrical engineer to make estimates for a municipal electric light plant, and an appropriation of $750 has been made for this work. Z.

SEATTLE, WASH.—Superintendent of Buildings R. H. Ober is authority for the statement that the city may construct a transmission line to the Tuberculosis Sanitarium at Richmond Highlands. O.

TACOMA, WASH.—Commissioner of Light Nicholas Lawson is back of the movement to convert the waste water at the McMillan reservoir into 1,600 horsepower of electricity. Definite action will be taken shortly. O.

FAIRFIELD, ME.—The D. M. Susi Power Company has been organized with a capital stock of $10,000 for the purpose of supplying gas and electricity in the towns of Troy, Unity, Thorndike, Burnham and Freedom.

PLYMOUTH, ILL.—Plymouth Electric Light & Power Company has been incorporated with a capital stock of $100,000 to operate a heat and light plant. The directors are Charles D. Virginia and Isaac Snorberger.

VANCOUVER, WASH.—The Portland Railway Light & Power Company has ordered work begun at once on the building of a power station, a two-story office and a sub-power station here, same to cost between $30,000 and $50,000. O.

ANNVILLE, PA.—The Metropolitan Electric Company, of Reading, Pa., plans to expend $1,500,000 in improvements to its lines between this town and Reading during the coming year. Six high-tension cables will be erected.

FLATONIA, TEX.—C. A. Pierason, of Axtell, Neb., has purchased the electric light and power plant, the waterworks system and the ice factory near here and will make extensive enlargements and improvements to the property. D.

GARY, IND.—The Gary Heat, Light & Water Company has increased its capital stock $1,500,000 and will greatly increase its facilities in order to take care of its rapidly growing business. Some new and modern machinery will be installed. S.

CASHMERE, WASH.—The City Council has passed an ordinance providing for the installation of cluster lights on certain streets, same to cost approximately $4,000. Bids for the installation of same and material are asked. O.

GOSHEN, IND.—The City Council of this place has adopted plans for the rehabilitation of the municipal lighting plant. Burns & McDonnell, consulting engineers, have charge of the specifications for these improvements, which it is estimated will cost $50,000.

MOUNT VERNON, O.—The Mt. Vernon Power & Light Company has been incorporated with a capital stock of $250,000 to do a light, heat and power business. The incorporators are H. L. Montgomery, W. H. Pomerene, George H. Booth, David T. Keating and C. B. Donahue.

WHEELING, W. VA.—Wheeling Valley Light & Power Company has been incorporated with a capital stock of $50,000 to do a heat, light and motive power business. The incorporators are M. S. Jones, John W. Adams, Harry L. Bond, Sadie E. Adams, Ella L. Bond, all of Wheeling.

OROVILLE, CAL.—The Great Western Power Company announces that upon the completion this year of the Big Meadows dam, work will begin immediately on the construction of four additional power plants at a cost of $8,000,000. It is planned to develop a total of 675,000 horsepower, the installation to be complete by 1915.

PORT TOWNSEND, WASH.—The City Council recently granted the Key City Light & Power Company a 50-year franchise for the manufacture and distribution of electricity, gas, heat and power in the city limits and for the use of certain streets for transmission of same throughout the city. O.

BIRMINGHAM, ALA.—T. H. Friel is authority for the statement that the Birmingham Light, Water & Power Company will on April 1 commence operations in harnessing the water power of the Warrior River at Lock 17. It is expected that within 15 months after work starts current will be supplied to this city.

BUFFALO, N. Y.—The American Cataract Power Company has been incorporated with a capital stock of $1,000,000 to generate and store electric power. The directors of the company are John F. McDonald, George R. Teller, Howard A. Forman, E. L. Koons, Henry R. Hoffeld, H. A. Meldrum, Eugene L. Falk, William M. Wall and Robert F. Hefford, all of Buffalo.

SPRINGFIELD, MO.—The Springfield Gas & Electric Company has filed a petition alleging that the new rate recently named is confiscatory of its property and should be declared illegal. The backers of the new ordinance represent a number of the leading business men of this city, who state that they are ready to erect a $350,000 electric lighting plant when a franchise is granted them.

NEW WESTMINSTER, B. C.—The Western Canada Power Company, of which William McNeil is general superintendent, has under contemplation the construction of a power line across Burnaby Municipality to the north arm of the Fraser River, which would supply power to a large portion of Burnaby, the manufacturing sites along the north arm of the Fraser River, and on Lulu Island. Work is expected to begin shortly. O.

TACOMA, WASH.—Officials of this city have expressed themselves in favor of building a transmission line between the municipal light plants of this city and Seattle, so that either city will have protection in case of accident to the light and power plants. The commissioners of Tacoma will take up the matter shortly and the proposition will probably be submitted to the voters at the fall election. The cost of the work approximates the expenditure of about $100,000. O.

SPARTANBURG, S. C.—The Blue Ridge Interurban Railway Company has decided to undertake the development of a hydroelectric site on the Big Hungry River, about seven miles from this city. It is planned to develop 50,000 horsepower, which is to be transmitted to various cities and towns in the Carolinas. Ladshaw & Ladshaw, this city, are the engineers in charge of the development, and Sellers & Rippey, of Philadelphia, are interested in the project.

DEMING, N. M.—The Mimbres Valley Alfalfa Farms Company has entered

into a contract with the Federal Light & Traction Company for the construction of an electric power transmission line from Deming to a large tract of land which it is developing near here. It is stated that the Federal Light & Traction Company will install a large electric power station at Deming and that the present plant will be dismantled. The new power plant will cost about $400,000. D.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

GREENWOOD, MICH.—The Greenwood Mutual Telephone Company has been incorporated with a capital stock of $1,000.

BERLIN, WIS.—All the telephones in this city will be replaced with the more modern type and the switchboard remodeled.

COLVILLE, WASH.—The Farmers' Telephone System will be extended from Colville to the Pend Oreille Lakes, 27 miles distance. O.

MAINE, WIS.—A telephone company has been formed in this town for the purpose of building a line which will extend to Merrill.

CARSON, VA.—Carson Telephone Company has been incorporated with a capital stock of $2,500. W. T. Saunders is president of the company.

PADUCAH, KY.—The East Tennessee Telephone Company is planning extensive improvements in this city. It is said that $300,000 has been appropriated for this purpose.

BELMONT, KY.—J. W. Gahan, E. B. Triblett and I. T. Mudd have filed articles of incorporation for the Belmont & Shepherdsville Telephone Company, capitalized at $225. G.

GENESEO, ILL.—Geneseo Munson Line Mutual Telephone Company has been incorporated with a capital stock of $2,500. The incorporators are Allan B. Cady, A. S. Offerie and A. S. McAvoy.

PORT TOWNSEND, WASH.—The City Council has ordered the installation of an electrically-operated fire-alarm system. Bids for material and for the installation of same will be received in the immediate future. O.

OKLAHOMA CITY, OKLA.—A charter has been issued to the Clark Creek Valley Telephone Company, of Doby Springs, having a capital of $400. The incorporators are J. W. Blanchard, and A. T. Butler, of Doby Springs. P.

WILMINGTON, DEL.—It is stated that the Diamond State Telephone Company will make a number of extensions to its system this spring. More than five miles of underground cable containing from 100 to 600 pairs of wires will be laid.

TRENTON, N. J.—The Board of Public Utility Commissioners has approved of ordinances granting franchises to the New York Telephone Company at Dunellen and through Somerset County, for the construction of new telephone lines. A.

LUDLOW, KY.—The Queen & Crescent Railroad Company, of Cincinnati, O., is planning to equip its division from Ludlow to Williamstown, Ky., a distance of 35 miles, with electric train dispatching and block signal systems. Electric lights in all stations along the line will also be installed. Telephone service will take the place of the present telegraph in dispatching. G.

ELECTRIC RAILWAYS.

(Special Correspondence.)

TACOMA, WASH.—Plans for a municipal car line are being discussed by the City Commission.

MILLBURN, N. J.—The Morris County Traction Company is planning for the double tracking system on Main Street. A.

CHICAGO, ILL.—Announcement has been made that the Chicago & Joliet Electric Railway Company will expend nearly $200,000 in the improvement of its local system the coming season.

CHARLEROI, PA.—It is stated that the West Side Electric Street Railway Company expects to build and maintain a trolley line through this borough.

BELOIT, WIS.—Statement has been made that the Bank of France is behind a project to build an interurban between Beloit and Delavan. It is also said that American capitalists are interested.

GREENVILLE, TEX.—The Greenville Electric Street Railway Company has purchased the street railway that runs between Greenville and Mineral Heights and will greatly improve the system. D.

CINCINNATI, O.—The Cincinnati & Southern Kentucky Traction Company has been incorporated with a capital stock of $10,000 by W. H. Thomas, J. M. Dawson, T. J. Green, W. E. Moore and R. C. Green.

NEWCASTLE, PA.—It is reported here that the Mahoning & Shenango Valley Railway Company expects to make a survey of a route to New Wilmington and in all probability a line will be built to the college town.

DENVER, COLO.—Frank P. Read, of this city, is authority for the statement that Eastern capital is backing an electric line, which is to be built from Colorado Springs to Greeley. The total cost of building this interurban is estimated at $3,000,000.

READING, PA.—During the present year the Reading Transit Company expects to spend $1,750,000 on improvements in this city and suburbs, according to the statement of one of the officials. The work will start as soon as the weather permits. N.

PORTLAND, ORE.—The East Seventy-Second Street Improvement Club is agitating the proposition of having the Rose City car line extended. Interested parties along the proposed route have signified their willingness, and all but $7,000 of the money needed to construct the line is available now. O.

MONROE, WASH.—The Kirkland, Redmond Railway, Light & Power Company, of which W. P. Perigo, of Redmond, is promotor, will construct an electric line between this city and Kirkland. Preliminary surveys have been practically completed and work of construction will begin shortly. O.

JACKSONVILLE, FLA.—Announcement has been made that the Jacksonville-St. Augustine Public Service Company will start construction of an electric line between the two cities, also a branch of 16 miles from Jacksonville to Diego and Pablo Beach. In all about 55 miles of electric line will be built.

ASHLAND, ORE.—A franchise has been granted to M. T. Minney and his associates, of Oakland, Cal., for an interurban and street railway. The same parties have been granted a franchise in Medford and the company promises to commence work at once. It is rumored that the Hill interests are behind this project.

GALVESTON, TEX.—The Galveston-Houston Interurban Railway Company is preparing to make large improvements to its line, which runs between Galveston and Houston, a distance of 51 miles. It will also construct two or three branch lines to thriving towns and communities situated in the territory it traverses. D.

HONOLULU, H. I.—Articles of incorporation have been filed for the Hilo Traction Company, Limited, with a capital stock of $2,000,000, by H. V. Patten, Carl S. Carlsmith, Leland S. Conness, W. H. Johnson, C. E. Wright and Delbert E. Metzger. The company proposes to equip the city of Hilo with a street-car system.

SAN DIEGO, CAL.—The Mexican & San Diego Railway Company has been incorporated with a capital stock of $215,000 by E. S. Babcock, R. B. Talbott, L. H. Brown, A. Goodrich and Thomas M. Leevey. It is proposed to build a line from National City to the salt works in South San Diego, owned by Mr. Babcock, who is president of the new company.

VINITA, OKLA.—The Oklahoma Northern Railroad Company has secured a charter with a capitalization of $50,000 for the purpose of building an electric line through Nowata to Coffeyville, Kans. The incorporators named are C. D. Meiklejohn, A. King and H. L. Steen of Omaha. The line will be about 42 miles in length and is estimated to cost $35,000 a mile to build.

ST. LOUIS, MO.—The St. Louis, Affton & Sunset Railway Company has filed articles of incorporation with a capital stock of $300,000. The company proposes to build an electric line from Affton to Sunset, Ind., and Fenton, *via* Sappington. The incorporators of the new company include Victor J. Miller, John M. Storm, J. L. Boehl, James Arbuckle and C. A. Bodwell.

TEMPLE, TEX.—The Southwestern Traction Company, which owns and operates the interurban electric railway between Temple and Belton, about ten miles, has succeeded in financing the construction of an extension of the line from Temple to Marlin, 30 miles, and is now working on plans to build a trunk interurban railway between Dallas and Houston, 250 miles, *via* Marlin. It is stated by A. F. Bentley, president of the company, that the construction of the Marlin extension will soon be started and that plans for building the proposed trunk line are well advanced. D.

ST. JOHN, N. B.—The St. John Suburban Railway Company has filed articles of incorporation in New Brunswick, with a capitalization of $950,000. It is announced that this syndicate has offered to purchase the St. John Street Railway Company properties, in which event the new owners intend to construct a comprehensive suburban system in extension of the present local lines, which comprise only about 13 miles of track. This syndicate is also interested in the St. John Hydro-Electric Company, which has a charter to sell electric-light and power current in St. John and vicinity. It is stated that this company will enter the St. John field for electric lighting whether or not it is successful in obtaining possession of the street railway company.

NEW INCORPORATIONS.

LITTLE ROCK, ARK.—Citizens Electric Company has been incorporated with a capital stock of $50,000 by S. W. Reyburn, Moorhead Wright and J. Merrick Moore.

TACOMA, WASH.—Tacoma Electrical Machinery Company has been incorporated with a capital stock of $20,000. J. C. Hill, John W. Holmes are named among the incorporators.

CHICAGO, ILL.—Egyptian Electric Company has been incorporated with a capital stock of $25,000 to do a general electrical business. The incorporators are A. A. Rolf, Alvin E. Stein and Matthew J. Mears.

CHICAGO, ILL.—Chicago Electric Castings Company has been incorporated with a capital stock of $11,000 for the purpose of manufacturing electric furnaces and equipment. Wilton Bentley, Edward C. Higgins and Matthew Finn are the incorporators.

NEW YORK, N. Y.—Electrical Service Company, Incorporated, has filed articles of incorporation with a capitalization of $600. This company will furnish electricity. The incorporators are George C. Scarlett and Randolph W. Newman and Charles D. Ettinger, of New York City.

NEW YORK, N. Y.—Spilger Electric Company, Incorporated, has been incorporated with a capital stock of $1,000 to do an electrical contracting business and deal in electrical goods. The incorporators are Peter Spilger, George Arras, Leslie Court, Paul V. Dooley and Anna Spilger, all of New York City.

NEW PUBLICATIONS.

PATENT LAW REVISION.—An article by Gilbert H. Montague entitled "The Proposed Patent Law Revision." has been reprinted from the *Harvard Law Review*. It is a concise and incisive discussion of the provisions of the Oldfield bill.

MINERAL PRODUCTION OF CANADA.—A preliminary report on the mineral production of Canada during the calendar year of 1912, prepared by John McLeish, has been issued by the Canadian Department of Mines. This is a pamphlet of 21 pages covering all mineral substances, including metals, coal, oil, asbestos, cement, etc.

WAUSAU FLOOD.—The devastation produced by the great flood of July 24, 1912, and the reconstruction work which ensued, has been described by M. C. Ewing, manager of the Wausau Street Railroad Company, in a neat 16-page pamphlet, illustrated with half-tones. The description of the exciting events connected with the flood must prove of interest to every reader.

KANSAS CITY RAILWAY VALUATION.—A printed report in three volumes has been prepared by B. J. Arnold, appointed special commissioner by the United States District Court, dealing with the valuation of properties of the Metropolitan Street Railway system of Kansas City, Mo. The report is rather lengthy and goes into details of the appraisement of the various components of the system.

TERRESTIAL MAGNETISM.—The annual report of the Director of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington for the year 1912 has been separately reprinted. This report appeared in the Yearbook of the Institute. It describes the work in the continuation of the magnetic survey of the oceans with the aid of the nonmagnetic ship *Carnegie*, as well as the surveys carried out on the land areas. The latter work extended over portions of Africa, Asia, Australasia and South America.

FINANCIAL NOTES.

A decree entered in the U. S. District Court sets April 8 for the sale of Chicago properties of the Allis-Chalmers Company. Properties comprise two works and bids must be accompanied by $150,000 in cash or $300,000 in bonds.

Shareholders of Massachusetts Electric Company authorized trustees to issue $3,500,000 coupon notes, to be sold at prices in discretion of trustees. Proceeds will in part refund an issue of notes maturing July 1. Shareholders also authorized trustees to sell all first-preferred stock of Bay State Street Railway which Massachusetts Electric may acquire during the current year.

The fiscal year of the Westinghouse Electric & Manufacturing Company ends with the current month. The company had a record year in gross earnings, this figure totaling between $40,000,000 and $41,000,000, compared with the best previous year, 1911, when $38,119,312 was shown. The company has made a steady increase in gross sales since the first of the current fiscal year, and from the beginning of 1913 prices have also shown a more encouraging appearance.

The New England Power Company has just issued $1,000,000 six-per-cent cumulative preferred stock. The proceeds will be used to complete construction of the company's so-called "No. 5" station, above the Hoosac Tunnel, Mass. This issue will round out some five years of financing of allied hydroelectric developments on the Connecticut and Deerfield Rivers. The opening of these properties, which has been accomplished chiefly with Boston and New England money, now constitutes them the largest hydroelectric system in the country east of Niagara Falls.

An offering of $2,350,000 six-per-cent preferred stock with a bonus of 40 per cent of common stock of the Eastern Power & Light Company is made by William P. Bonbright & Co., W. S. Barstow & Company and the Equitable Trust Company. The Eastern Power & Light Company has been organized under the laws of Virginia with a capitalization of $2,350,000 five-year five-per-cent convertible-collateral trust notes, $10,000,000 six-seven-per-cent preferred stock, and $10,000,000 common stock. The preferred stock bears dividends at six per cent a year until March, 1916, when this will be increased to seven per cent. Properties acquired are around Reading, Pa., and eastward, Morgantown, W. Va., Wheeling, W. Va., Vincennes, Ind., and some small properties in New Hampshire and Vermont.

The Salida Light, Power & Utility Company, one of the oldest hydroelectric developments in Colorado, has been sold to the reorganization committee of the Central Colorado Power Company for $500,000 cash. Central Colorado Power will be sold at receiver's sale in Denver, March 31 and will be bid in by the reorganization committee for the bondholders of the bonds of Central Colorado Power and Leadville Light & Power Company will receive bonds, common and preferred stocks in the new corporation for their holdings of bonds in the old companies. Previous to the receivership the purchase of the Salida property was under consideration and it has now been made with the view of providing for additional power requirements when the electrification of the mountain lines of the Denver & Rio Grande is carried out.

Dividends.

Associated Gas & Electric Company; a quarterly preferred dividend of 1.5 per cent, payable April 1 to stock of record March 20.

Buffalo General Electric Company; a quarterly divident of 1.5 per cent, payable March 31 to stock of record March 20.

Canadian General Electric Company; a quarterly common dividend of 1.75 per cent, and a semi-annual preferred dividend of 3.5 per cent, both payable April 1 to stock of record March 15.

Central Mexican Light & Power Company; a quarterly preferred dividend of 1.5 per cent, payable April 1 to stock of record March 15.

Central States Electric Company; a quarterly preferred dividend of 1.75 per cent, payable April 1 to stock of record March 10.

Chicago City, Railway Company; the regular quarterly dividend of 2.5 per cent, payable March 29 to stock of record March 4.

El Paso Electric Company; a semi-annual common dividend of $3.50 per share, payable March 15 to stock of record March 8.

Interborough Rapid Transit Company; a quarterly dividend of 2.5 per cent, payable April 1 to stock of record March 24.

Manhattan Railway Company; the regular quarterly dividend of 1.75 per cent, payable April 1 to stockholders of record March 15.

Manila Electric Railroad & Lighting Corporation; a quarterly dividend of 1.75 per cent to stockholders of record on March 19, payable April 1. This is an increase of one-quarter per cent over the previous dividend.

Pacific Gas & Electric Company; a quarterly dividend of $1.25 per share, payable April 15 to stock of record March 15.

Philadelphia Company; the regular dividend of 1.75 per cent upon its common stock, payable May 1 to stockholders of record April 1. It has also declared a semiannual dividend of three per cent upon the new cumulative six-per-cent preferred stock, payable May 1 to stockholders of record April 10.

Philadelphia Traction Company; a semi-annual dividend of four per cent, payable April 1 to stock of record March 10.

Providence Telephone Company; a quarterly dividend of $1 per share, payable April 1 to stock of record March 20.

Toronto Railway Company; a regular quarterly dividend of two per cent payable April 1 to stock of record March 15.

United Traction & Electric Company; a dividend of 1.25 per cent to holders of record March 11, payable April 1.

West End Street Railway Company; a quarterly common dividend of $1.75 per share, payable April 1 to stock of record March 22.

Reports of Earnings.

WINNIPEG RAILWAY.

The report of the Winnipeg Electric Railway Company for the year ended December 31, 1912, shows net earnings of $1,761,296, against $1,928,782 in 1911. The balance available for dividends was $1,194,463 equal to 14.27 per cent on the capital stock, as compared with 18.50 per

cent earned the previous year. The income account compares as follows:

	1912	1911
Gross revenue	$3,765,384	$3,829,749
Operating expenses	2,004,147	1,900,968
Net revenue	$1,761,236	$1,928,782
Fixed charges	566,733	818,208
Balance	$1,194,463	$1,110,574
Dividends	720,000	690,000
Year's surplus	$ 474,463	$ 420,574
Previous surplus	1,616,773	1,196,199
Total surplus	$2,091,236	$1,616,773

DULUTH TRACTION COMPANY.

The report of the Duluth Superior Traction Co. for the year ended December 31, 1912, shows net earnings of $453,072, against $527,165 in 1911. After allowing for four per cent on the preferred stock, the balance available for common dividends was $173,776, equal to 4.67 per cent on the common stock, as compared with 7.4 per cent earned the previous year. The income account compares as follows:

	1912	1911
Gross	$1,083,259	$1,135,299
Expenses	630,187	608,135
Net earnings	453,072	527,165
Interest and taxes	219,296	208,161
Surplus	233,776	319,003
Preferred dividends	60,000	60,000
Common dividends	175,000	175,000
Depreciation	70,114	58,288
Deficit	71,338	*25,715

*Surplus.

AMERICAN CITIES COMPANY.

The following comparative statement of earnings of American Cities Company, accruing through its holdings of constituent companies, for the twelve months ended December 31, 1912, has been issued:

	1912	1911
Earnings on shares owned	$2,282,593	$2,076,935
Int. Am. Cities bds.	500,000	500,000
Balance for preferred stock	1,782,593	1,576,935
Dividends on preferred stock	1,233,210	1,230,852
Balance for common stock m	549,383	346,083

For 1912, American Cities earned 3.4 per cent on its outstanding common stock, as against 2.1 per cent in 1911. The increase in gross earnings was 9.90 per cent; in balance for preferred dividends 13.4 per cent, and in balance for common stock 58.74 per cent, greater in 1912 than in 1911.

NORTHERN STATES POWER COMPANY.

Northern States Power Company reports earnings and expenses for the year ended January 31, 1913, with the earnings of the Minneapolis General Electric Company included for but eight months of the period:

Gross earnings	$3,033,723
Expenses and taxes	1,531,149
Net earnings	1,504,573
Fixed charges	920,484
Net profits	584,089
Preferred dividends	447,698
Balance	136,391

Northern States Power has outstanding $5,975,000 common and $8,386,700 preferred stock with $5,000,000 six-per-cent notes. The bonds of its constituent companies outstanding aggregate $17,465,000. Included in the fixed charges are dividends on 70 shares of Minneapolis General Electric preferred which have not yet been acquired.

BELL TELEPHONE COMPANY.

The report of the Bell Telephone Company of Canada for the year ended December 31, 1912, shows a net income of $1,598,094, against $1,425,836 in 1911. During the year the company issued $2,500,000 new stock and $1,750,000 new bonds. The capital stock now issued is $15,000,000, and the total bond issue is $6,600,000.

The retiring directors were reappointed and U. N. Bethell and C. E. Sise, Jr., were added to the board. The income account for the fiscal year compares as follows:

	1912	1911
Gross	$7,6383,04	$6,476,849
Expenses, tax, depreciation, interest, etc.	6,040,210	5,051,012
Net income	$1,598,095	$1,425,836
Dividends	1,148,961	1,000,000
Surplus	$449,133	$425,836

CHICAGO TELEPHONE COMPANY.

The Chicago Telephone Company reports the following statement of earnings for 1912-1911:

	1911.	1912.
Gross earnings	$12,678,390.57	$14,538,399.43
Operating expenses	5,203,107.32	5,730,674.54
Current maintenance	2,548,221.44	2,655,550.98
Depreciation	1,680,000.00	2,063,594.00
Taxes	720,000.00	792,871.30
	10,151,328.76	11,242,690.82
Net earnings	2,527,061.81	3,295,708.61
Deduct: — interest	264,521.50	761,296.09
Balance	2,262,540.31	2,534,412.52
Deduct: — dividends, 8 per cent	2,160,000.00	2,160,000.00
Surplus earnings	$102,540.31	$374,412.52

The total number of telephones, December 31, 1912, was 382,537, as compared with 202,681 December 31, 1907. The increase for the year was 48,074.

NEW YORK TELEPHONE COMPANY.

The report of the New York Telephone Company for the year ended December 31, 1912, compares as follows:

	1912	1911
Telephone revenue	$42,223,623	$39,189,966
Expenses and taxes	31,276,208	29,013,188
Net telephone earnings	11,947,415	10,176,777
Dividends and interest	5,356,176	5,043,707
Miscellaneous earnings.	9,579	2,536
Total net earnings	17,313,170	15,223,020
Interest charges	2,951,845	2,395,826
Balance	*14,361,325	12,827,194
Dividends	10,000,000	10,000,000
Surplus	4,361,325	2,827,194

*Equal to 11.48 per cent on $125,000,000 capital stock, as compared with 10.25 per cent on same stock previous year.

President U. N. Bethell says:

"On December 31, 1912, there were 985,780 stations in the system directly operated by your company and its local connecting companies, an increase during the year of 97,445. Including the associated and connecting companies, there were in service in the whole system at the end of the year 1,756,343 stations, an increase during the year of 232,319 stations.

"A plan for employees' pensions, disability benefits and insurance was adopted during the year, effective January 1, 1913. The provisions of funds to carry it out is made entirely by the company and its associated companies interested, without contribution of any kind from the employees themselves. As indicated in the foregoing statement, $2,000,000 was set aside by your company for all employees of every rank. It provides for change of employment from one Bell Company to another, with full credit for combined terms of service."

STONE & WEBSTER PROPERTIES.

Stone & Webster have issued their Electric Railway and Lighting Properties Manual for 1913, giving brief descriptions of the various properties under the management of the organization, together with statements of capitalization, earnings and expenses for the year 1912, and particulars regarding the securities. Following is a combined statement of the companies for the calendar year 1912:

Capitalization—	
Bonds and coupon notes outstanding	$80,742,700.00
Preferred stock outstanding	33,579,400.00
Capital and common stock outstanding	59,057,100.00
Total	$173,379,200.00
Earnings and Expenses, 1912—	
Gross earnings	$23,925,414.63
Operating expenses and taxes	13,839,417.32
Net earnings	$10,085,997.31
Interest charges	4,075,222.64
Balance	$6,010,774.67
Bond sinking and mortgage improvement funds	532,820.10
Balance	$5,477,954.57
Income from other sources	77,405.60
Balance	$5,555.360.17
Dividends paid	3,699,119.47
Balance for reserves and depreciation	$1,856,240.70
Total disbursement for the year 1912, for interest on bonds and notes and for dividends	$7,774,342.11
Miles of equivalent single track owned	1,224.8
Passengers carried (including transfers)	318,203,000
Total connected electric lighting load, equivalent to 16 candlepower lamps	2,136,960
Total commercial power load, approximately (horsepower)	137,400
Total combined power station capacity (of which 110,200 horsepower is generated by water-power), approximately (horsepower)	276,780

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	March 10	March 3
American Tel. & Tel. (New York)	132½	132½
Commonwealth Edison (Chicago)	141	140
Edison Electric Illuminating (Boston)	*280	280
Electric Company of America (Philadelphia)	*12	*12
Electric Storage Battery common (Philadelphia)	51⅜	51¾
Electric Storage Battery preferred (Philadelphia)	51⅜	51¾
General Electric (New York)	137½	139
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1⅜	1½
Massachusetts Electric common (Boston)	16½	16½
Massachusetts Electric preferred (Boston)	76	76
National Carbon common (Chicago)	118¼	118
National Carbon preferred (Chicago)	114	115
New England Telephone (Boston)	153	153
Philadelphia Electric (Philadelphia)	22⅝	23⅛
Postal Telegraph and Cables common (New York)	81	81
Postal Telegraph and Cables preferred (New York)	66	65
Western Union (New York)	67	68
Westinghouse common (New York)	68	69
Westinghouse preferred (New York)	117	115

*Last price quoted.

PERSONAL MENTION.

CARL M. TEVIS who has been manager for the Central Union Telephone Company at Seymour, Ind., has been appointed manager for the Inter-State Telephone Company at Elgin, Ill., to succeed GEORGE GALLOWAY, resigned.

JOHN M. REDMOND, formerly with the People's Gas & Electric Company has purchased an interest in the plumbing business of Charles G. Bosch, Burlington, Iowa, and will have charge of a newly created electrical supply and contracting department.

WILLIAM G. MEROWITZ has severed his connection with the Holtzer-Cabot Electric Company's motor organization and has accepted the position of power apparatus sales specialist with the supply sales department of the Northern Electric & Manufacturing Company, Montreal, Canada.

WILBUR C. FISK, vice-president of the Hudson & Manhattan Railroad, operating the tubes under the Hudson River and connecting the railway terminals in New York and New Jersey, has been elected president to succeed WILLIAM G. McADOO, who has become Secretary of the Treasury in President Wilson's Cabinet.

JACOB WALKER has resigned as superintendent of the electric light and power station of Augusta, Ky., after five years' service in that position. He will retire from active business and will live upon a farm owned by him in Mason county, Ky. CLAY MONEYHAN has succeeded Mr. Walker as superintendent at Augusta.

LOUIS A. ALEXANDER superintendent of the F. Bissell Company, made an address Friday evening of last week at the Commerce Club before the members of the Toledo Section of the American Institute of Electrical Engineers. The lecture covered technical features of high speed motors in the operation of vacuum cleaners and pumps.

RALPH W. E. DONGES, of Camden, N. J., has been appointed a member of the New Jersey State Board of Public Utility Commissioners by Governor Wilson, succeeding Robert Williams of Paterson, N. J. Mr. Donges is a prominent lawyer and is Captain of the Third Regiment, National Guard, State of New Jersey.

J. F. McGUIRE has been appointed manager of the Consumer's Power Company, Minot, N. D., succeeding H. E. BRANDLI resigned. Mr. McGuire has been connected with H. M. Byllesby & Company's new business department for several years, recently in the capacity of manager of the new business department of the Consumers' Power Company, Faribault, Minn., division.

ROBERT W. CLARK, for several years connected with the Minneapolis General Electric Company, Minneapolis, Minn., and since the management of the company was taken over by H. M. Byllesby & Company having served in the capacity of assistant sales manager, has resigned to accept a position with the Puget Sound Traction, Light & Power Company, Seattle, Wash.

R. P. BROWN, president of the Brown Electrical Instrument Company, which has taken over the entire business of the Keystone Electrical Instrument Company, was a visitor to Chicago last week attending the convention of the Brick Manufacturers' Association and the Clay Products Exposition at the Coliseum. The Brown Company exhibited a complete line of pyrometers for brick-kiln and clay-furnace work.

BURDETTE STRYKER, plant superintendent of the Harrisburg division of the Bell Telephone Company of Pennsylvania, has been promoted to a similar position in the Pittsburgh division, with headquarters in Pittsburgh. Mr. Stryker was promoted to his Harrisburg position three years ago from superintendent of the Reading district. Prior to that he held responsible positions in Philadelphia, Baltimore and Washington.

JOHN GILMARTIN, manager of the meter department of the Toledo Railways & Light Company has resigned his position to enter the employ of the Detroit Edison Company at Detroit. Prior to his leaving for Detroit, a banquet was given in his honor at the Toledo Yacht Club, which was attended by 43 members of the meter department and heads of other departments of the company. GEORGE E. SNIDER has been appointed to the vacancy.

WILLIAM J. HAMMER, the well known consulting engineer, lectured at Smith College at Northampton, Mass., on February 24 under the auspices of the Physics Club of the College on the subject of "Selenium, its Properties and Applications." Mr. Hammer also delivered an address on March 8 before the members of the research laboratory of the General Electric Company at Schenectady. Mr. Hammer talked on the subject of "The Selenium Cell, its Scientific and Industrial Applications."

FRANK G. BOLLES, who for some time has been managing editor of the *Excavating Engineer*, published by the Bucyrus Manufacturing Company, has received an appointment as commercial agent to investigate trade conditions abroad by the Department of Commerce and Labor. Mr. Bolles is an expert in the study of trade conditions and has made several trips abroad upon similar investigations. It is understood that Mr. Bolles will be abroad for some time in his new undertaking.

OBITUARY.

PRESTON J. HURLBURT, for many years manager of the Western Union Telegraph office in Providence, R. I., died on March 4 at his home in Great Barrington, Mass. Mr. Hurlburt was known throughout the country as a telegraph operator of remarkable speed and accuracy.

JAMES J. INGRAM, for many years one of the best known telegraphers in the northern part of New York State, died on February 26 at his home in Ogdensburg. Mr. Ingram was born in Ogdensburg, September 14, 1849. During all the years of his active career he was identified with the telegraph business in Ogdensburg, entering the service of the old Vermont & Boston Telegraph Company as a messenger boy at the age of 13 years.

ALFRED STROMBERG, the well known inventor of many telephone devices, died on Saturday, March 8, at his home in Chicago, Ill., and was buried at Rosehill on Tuesday afternoon. Mr. Stromberg was born in Sweden, March 9, 1861, and came to the United States in 1883. He was connected for five years with the Chicago Telephone Company and later with the Chicago Electric Protective Company. Several years ago he organized the Stromberg-Carlson Telephone Manufacturing Company, independent telephone apparatus manufacturers. He was also president of the Stromberg Electric Company. He leaves a widow and four children, Mrs. Minnie Denniston, Alice, Eva and Emil Stromberg.

HARRY T. JOHNSON, president of the Manhattan Electrical Supply Company, New York, died on Wednesday March 5, after a short illness, at Daytona, Fla. About a year and a half ago Mr. Johnson was quite ill and went abroad for his health, returning after having apparently regained complete strength. He went away again in the middle of February seeming better than he had been for years, but was taken suddenly ill with a blood disease which caused his demise. Mr. Johnson was one of the founders of the business of the Manhattan Electrical Supply Company, and had been active in the organization since its beginning about 20 years ago. He was 52 years of age and leaves a widow, and a mother 93 years old.

DATES AHEAD.

Boston Automobile Show, Mechanics Building, Boston, Mass., March 8-22.

Railway Signal Association, Chicago, Ill., March 17.

Electrical Committee, National Fire Protection Association. Annual meeting, New York, N. Y., March 26-27.

National Association of Electrical Inspectors. Annual meeting, New York, N. Y., March 25-27.

American Electrochemical Society, Spring meeting, Hotel Traymore, Atlantic City, N. J., April 3-5.

American Institute of Electrical Engineers, Pittsburgh, Pa., April 18-19.

Mississippi Electric Association. Annual convention, Natchez, Miss., April 21-23.

Iowa Electrical Association. Annual convention, Waterloo, Iowa, April 23-24.

Iowa Street and Interurban Railway Association. Annual convention, Waterloo, Iowa, April 23-25.

Oklahoma Electric Light, Railway and Gas Association. Annual convention, Oklahoma City, May 6-8.

The Society for Electrical Development, Incorporated. Annual meeting, New York, N. Y., May 13.

National Fire Protection Association. Annual meeting, New York, N. Y., May 13-15.

Association of Railway Telegraph Superintendents. Annual meeting, St. Louis, Mo., May 20.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 21-24.

Electrical Supply Jobbers' Association. Spring meeting Chicago, Ill., May 26-28.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29.

National Electric Light Association. Annual convention, Chicago, Ill., June 2-5.

Canadian Electrical Association. Annual convention, Port Arthur and Fort William, June 23-25.

National Electrical Contractors' Association. Annual meeting, Chattanooga, Tenn., July 16.

Michigan Section, National Electric Light Association. Annual convention, Ottawa Beach Hotel, Ottawa Beach, Mich., August 19-21.

American Institute of Electrical Engineers. Annual Pacific Coast convention, Vancouver, B. C., September 9-11.

With the Electrical Manufacturers

Mathias Klein & Sons, Chicago, Ill., have made arrangements to manufacture and place on the market the Eichoff line-builders' wire reel. This device is a combination take-up and pay-out reel.

Dossert & Company, New York City, the well known makers of Dossert connectors, have appointed the **Delta-Star Electric Company,** 617 West Jackson Boulevard, Chicago, as their agents in Illinois, Iowa and Southern Wisconsin, including Milwaukee.

The Central Tube Company, Pittsburgh, Pa., has prepared a very attractive catalog devoted to a description and price lists of "Central White" and "Central Black" rigid conduit. Copies of this price list and description will be sent to those interested upon request.

Joseph Dixon Crucible Company, Jersey City, N. J., has published an interesting article by L. M. Stocking in the February issue of its monthly "Graphite." It points out forcibly the need of good paint to insure the life of metal structures and states briefly what are the advantages of Silica-Graphite paint for such service.

Hoyt Electrical Instrument Works, Penacook, N. H., has sent out blotters showing graphically the increase in floor space of its manufacturing establishment. In eight years this rose from 336 to 27,400 square feet, which is an excellent measure of the amount of business that the company has done in the line of Hoyt ammeters and voltmeters.

The General Insulate & Machine Company, Brooklyn, N. Y., voted at its annual meeting last week to change the name of the company to the General Insulate Company. The increasing demand for the company's product, "Insulate," has necessitated the further enlargement of the company's plant, although its output within recent months has been increased nearly 50 per cent.

The Robbins & Myers Company, Springfield, Ohio, has issued booklet No. 89, devoted to its Standard direct-current and alternating-current motors. A large variety of these machines, ranging from small fractional horsepowers to the 20-horsepower size are illustrated and described. Along with the motors are also a number of motor-generators, dynamotors, boosters and other small machines.

Thordarson Electric Manufacturing Company, 510 South Jefferson Street, Chicago, Ill., has placed on the market a new improved sign-lighting transformer. These transformers have been particularly designed for this service. They are said to be the smallest transformers used for commercial service, but have been found, notwithstanding, to be of high efficiency and of thoroughly reliable construction.

Harold R. Wilson Machinery Company, St. Louis, Mo., has issued its tenth list of electrical and steam apparatus. Included in this are a large number of direct-current and alternating-current generators and motors of various voltage and size. There are also many gas and steam engines, air compressors, pumps, etc. Although all of this machinery has been used, it is in excellent condition for further service.

Pass & Seymour, Incorporated, Solvay, N. Y., has issued bulletin No. 760 devoted to electric signs and various receptacles that this corporation manufactures particularly for use in electric signs. A large number of illustrations of striking signs appear in the publication. No less than 20 different sign receptacles are described and illustrated. There are also listed the P. & S. ready-wired sign receptacles which have been found very convenient in work of this kind.

International Oxygen Company, 115 Broadway, New York City, has issued some new publications describing its electrolytic apparatus for the generation of oxygen and hydrogen gases for various industrial purposes. Pamphlet No. 9 briefly describes the equipment and contains data regarding the cost of this method of generation in comparison with others. Bulletin No. 10 gives a more detailed technical description of the single-unit generator and describes its method of operation.

The Electric Controller & Manufacturing Company, Cleveland, Ohio, has issued a booklet entitled "Electrical Arithmetic." Fourteen problems relating to various difficulties in the control of electric motors of many types are briefly stated and their solutions given. Each problem is illustrated with a cut showing the type of machine that was involved and the type of control equipment that was found suitable for the particular problem. Most of these problems required automatic control equipment of one kind or another.

Tungstolier Works of General Electric Company, Conneaut, Ohio, is doing an important work for the fixture trade through its magazine the *Fixtureman.* This publication is complete with full information on all the latest Tungstolier developments in the fixture industry and contains an abundance of helpful suggestions which must prove valuable to the fixture dealer. The growth of the Tungstolier business in the past few years has been such as to make necessary the building of a new factory at Cleveland, Ohio, and it is said that it will be the largest fixture-manufacturing institution in the country.

National Metal Molding Company, Pittsburgh, Pa., has issued an attractive 28-page catalog of its metal molding and fittings. The cover is appropriately printed in the national colors. The uses and advantages of National metal molding are explained and over 50 fittings adapted for use in connection with it are described and illustrated so that the function of each can be clearly understood. Lever types of hand punch and hand shear are also described. This molding is particularly adapted for surface wiring in high-class office and mercantile buildings where flexibility and accessibility are desirable. The very complete line of fittings makes it possible to meet every condition and possible requirement.

The Luminous Unit Company, St. Louis, Mo., has issued a large folder devoted to its Brascolite semi-indirect lighting unit. About one dozen different designs of this fixture are illustrated with full-page engravings. Each of these is described and full data given respecting its dimensions and sizes of lamps for which it is particularly suitable. Many of these designs are highly ornamental. A detail of the interior construction of the unit is also shown. The advantages of these units are carefully pointed out. Some of them are made entirely of glass, others include in their construction metal chains and metallic or composition decorative features. They are suitable for a very large variety of installations.

Calculagraph Company, 9 to 13 Maiden Lane, New York City, has found that a rapidly increasing number of telephone companies are becoming convinced that an essential to success in all long-distance and toll business is an accurate check on the duration of each conversation. Since this service is invariably charged for by the minute in excess of a definite minimum, it is absolutely imperative, in justice both to the company and its patrons, to use a reliable instrument to measure the time the line was in active use. This the Calculagraph does; moreover, it prints the time of day when the line was placed at the subscriber's disposal and the elapsed time when it was released by him. These records eliminate guesswork and save thousands of dollars to the companies.

Sprague Electric Works of General Electric Company, New York City, has has issued three very attractive publications. One of these, designated as catalog No. 327, is devoted to Sprague electric fans of this year's design. This catalog is beautifully illustrated with special multi-colored cover and frontispiece. Seventeen types of direct-current fans are illustrated and described and ten types of alternating fans are similarly treated. These fans are suited for every purpose for which an electric fan is needed. Bulletin No. 115 is devoted to Sprague electrical equipment for buildings. This bulletin is illustrated with a large number of views of prominent buildings in which Sprague apparatus and appliances are used. Among the equipment described and illustrated are generators, switch-

boards, various types of conduit, wire, cable, conduit fittings, wiring devices, motors, controllers, etc. For each of these devices typical installations are shown. Bulletin No. 241 describes the Sprague motor drive for electrotyping and stereotyping machinery. This bulletin discusses the advantages of group and individual drive, describes the types of Sprague motors used for driving this class of machinery and shows many installations in which these motors are used for operating linotype and monotype machines, matrix-rolling machines, a variety of machinery for casting and finishing stereotype plates, engravers' machines of various kinds and also electroplating generator and motor-generator sets.

General Electric Company, Schenectady, N. Y., announces that among the very numerous orders for generating and power machinery recently received by it the following were noteworthy: Forged Steel Wheel Company, Butler, Pa., for three 2,500-kilowatt Curtis turbogenerator units, a 75-kilowatt induction motor-generator set, a 750-kilowatt synchronous motor-generator set, a 320-kilowatt motor-generator set, switchboard equipment and a number of large motors including one of 2,000, one 1,000, one 800 and one 600 horsepower; Chase Rolling Mill Company, Waterville, Conn., a 750-kilowatt Curtis turbogenerator and 50-kilowatt motor-generator set; Pittsburgh Crucible Steel Company, Pittsburgh, Fa., 115 motors ranging from 5 to 105 horsepower for its mill at Midland, Pa.; Weirton Steel Company, Weirton, W. Va., two 750-kilowatt, two-unit motor-generator sets, six 50-horsepower, six 150-horsepower, four 300-horsepower, nine 25-horsepower, two 10-horsepower motors and switchboard apparatus; Lackawanna Steel Company, Buffalo, N. Y., three 200-horsepower motors; Mathieson Alkali Works, Saltville, Va., a 375-kilowatt Curtis turbogenerator, a 35-kilowatt motor-generator set, a 50-horsepower induction motor and switchboard; Whitlock Cordage Company, Jersey City, N. J., a 625-kilowatt Curtis turbogenerator with 10-kilowatt turbo-exciter and 25-kilowatt motor-generator exciter sets and switchboard apparatus; Dewey Portland Cement Company, Dewey, Okla., a 1,125-kilowatt generator, a 150-kilowatt motor-generator set and switchboard, two 75-horsepower, four 20-horsepower motors and two 10-horsepower motors; Oro Electric Corporation, Stockton, Cal., a 1,000-kilowatt Curtis turbogenerator with 10-kilowatt turbo-exciter and 14-kilowatt generator, Tirril regulator, 20-horsepower motor and switchboard; Pacific Light & Power Corporation, Los Angeles, Cal., ten 5,000-kilowatt and three 1,000-kilowatt transformers; Great Western Power Company, San Francisco, Cal., six 300-kilowatt transformers and two panels for the station at Denverton, Cal., also three 300-kilowatt transformers in the station at Sheldon.

Record of Electrical Patents.

Issued by the United States Patent Office, March 4, 1913.

1,054,690. Electric-Wire-Supporting Device. H. A. Hicks, Gerty, Okla. A crossarm with transverse recesses for receiving inverted U-shaped insulators.

1,054,717. Fuse. A. W. Schramm, assignor to Electro Dental Manufacturing Co., Philadelphia, Pa. A cartridge fuse is inserted in a fuse-holder formed in a transverse hole through the switch panel.

1,054,746. Lamp Socket. W. E. Christian, assignor to Badger Brass Manufacturing Co., Kenosha, Wis. A special socket adjustable at the center of a reflector of an automobile headlight.

1,054,747. Lamp. W. E. Christian, assignor to Badger Brass Manufacturing Co. A modification of the foregoing, the lamp body having a door.

1,054,750. Cable-Hanger. A. L. Cooper, Odessa, Mo. A wire hook over the messenger strand holds the marline cable-supporting loop.

1,054,758. Propeller-Fan. S. T. Fornander, New York, N. Y. A motor-driven fan with hollow helicoidal blades drawing air at the center and discharging at the rear outer edges.

1,054,759. Lighting Fixtures for Theaters and Public Halls. G. H. Fowler, assignor to Fowler Sign Co., Tacoma, Wash. A cove-lighting outfit with semi-cylindrical reflector, tubular lamps and curved light-diffusing panel.

1,054,766. Electric-Heating System for Cars. F. Hedley, Yonkers, and J. S. Doyle, Mount Vernon, N. Y. Heated air from motor-starting resistances is conveyed through floor of car from resistance-inclosing casing beneath.

1,054,767. Electric-Railway-Car-Heating System. F. Hedley and J. S. Doyle. The controller is arranged to open the heater circuit while the motor circuit is closed and to close the former when the latter is open.

1,054,783. Electromagnetic Motor. G. M. Mayer, assignor to Atwater Manufacturing Co., North Chicago, Ill. Includes a single field magnet with segmental poles, an armature with radial magnets.

1,054,784. Electric Cable. F. R. McBerty, assignor to Western Electric Co., Chicago, Ill. A woven multi-conductor cable formed of wires as the warp and insulating threads as the woof.

1,054,801. Secondary or Storage Battery. E. W. Smith, Philadelphia, Pa. The plate has vertical rods, surrounded by active material and externally protected by insulating tubes.

1,054,809 and 1,054,810. Electrical Connector. R. H. Welles, assignor to Badger Brass Manufacturing Co. Within a sleeve is a connector plug with longitudinal contact pins.

1,054,811. Means for Controlling Electric Apparatus. E. H. Widegren and K. A. Widegren, Albra, Sweden. For telegraphic transmission of writings or drawings by means of pulsating currents.

1,054,815. Temperature-Regulating Means for Cars and the Like. W. Barstow, San Francisco, Cal. Includes an electric heater, a cooler, a generator, a storage battery, a thermostat and electromagnetic control for the system.

1,054,817. Art of Manufacturing Cement Steel. G. H. Benjamin, New York, N. Y. Puddle bars are subjected to the action a polyphase current and a hydrocarbon gas.

1,054,835. Jar for Secondary or Storage Batteries. B. Ford, Philadelphia, Pa. A multiple jar with intermediate partitions so as to accommodate several independent cells.

1,054,845. Circuit-Breaker. L. E. Hodges, Covina, Cal. Expansion of a thermostatic bar opens the circuit.

1,054,853. Drying Machine. H. Löfquist, Stockholm, Sweden. Has an electric heater surrounding the clothes drum.

1,054,862. Variable Inductance. T. E. Paling, Dundas, Ont., Can. One coil is fixed between and the other is longitudinally adjustable between two parallel iron bars.

1,054,872. Portable Electric Generating Apparatus. V. Sence, New York, N. Y. A small generator operated by hand through lever and gearing is mounted in a flask with a lamp in its neck.

1,054,886. Method and Apparatus for Producing Long Electrical Arcs. F. H. A. Wielgolaski, Christiania, Norway. The arc is subjected to a thin, wide magnetic field to stretch it out.

1,054,887. Automatic Telephone-Exchange System. Friedrich Wöhler, assignor to Western Electric Co. Includes automatic switches and a busy-test outfit.

1,054,891. Wire-Winding Machine. C. E. Anderson, assignor to American Electrical Works, Phillipsdale, R. I. The coil receiver and supply spool can be driven in opposite directions.

1,054,893. High-Potential Electric Switch. C. C. Badeau, assignor to Sears B. Condit, Jr. An oil switch includes an oil-immersed series transformer and disconnecting switches.

1,054,902. Resistance Device. L. Bradley and H. L. Bradley, assignors to Allen-Bradley Co. Consists of a column of graphite plates with a surface coating of carbonized coal tar.

1,054,909. Spark-Plug Tester. A. de Clairmont, Toledo, O. Has two spaced electrodes with means whereby either may be engaged with a spark plug.

1,054,911. Mail-Box. W. H. Dodson, Bovill, Idaho. A motor-driven mail receptacle is suspended from a trolley wire.

1,054,917. Remote-Control Electric Switch. J. R. Gunn, Detroit, Mich. Operated by a solenoid.

1,054,923. Safety Indicator and Control for Elevators. P. T. Kenny, New York, N. Y. As the speed increases an electric car signal is operated, then the control circuit is broken and a second signal operated.

1,054,937. Voltage-Regulator. M. Pfeffer, assignor to General Electric Co. Each of a set of parallel generators has a regulator responsive to changes in its power-factor and to current changes in the main line.

1,054,939. Snap-Switch. C. D. Platt, Bridgeport, Conn. Relates to details of the spindle.

1,054,946. Self-Locking Lamp-Socket. W. A. Stacey, Chicago, Ill. Has a wire spring helix that engages the thread of the lamp base.

1,054,954. Illuminated Sign. J. M. Williams, Jr., Greenwich, Conn. Includes incandescent lamps and special reflectors within a casing.

1,054,965. Fuse Cartridge. F. J. Ferrari, Syracuse, N. Y. The fuse carrier can be slipped in through the end, forming sliding contact with the end ferrules of the case.

1,054,971. Burglar-Alarm. J. E. Liljeblad, Chicago, Ill. Tampering with a cord closes the alarm circuit.

1,054,996 and 1,054,997. Magnetic Speedometer. J. K. Stewart, Chicago, Ill., assignor to Stewart-Warner Speedometer Corporation. Includes a revolving magnet, an opposed armature and an interposed rotating member of low resistance.

1,055,003. Electrode for Producing Arcs. G. Wagener, assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. Has a metallic core surrounded by cement.

1,055,016. Electric Ground-Detector. G. A. Burnham, assignor to S. B. Condit, Jr., Brookline, Mass. A motor-driven brush engages the line contacts successively.

1,055,035. Electric Switch. E. R. Hamilton, Chicago, Ill. Has a clock for preventing rotation of the operating member.

1,055,046. Wiring Tack. B. G. Jansson, assignor to Blake Signal & Manufacturing Co., Boston, Mass. Made from a single piece of wire so as to leave spaced extensions for receiving the wire.

1,054,965.—Refillable Fuse.

1,055,062. Socket for Incandescent Electric Lamps. J. K. Lux, assignor to Pass & Seymour, Solvay, N. Y. The key consists of a reciprocating push-bar with rack engaging the switch pinion.

1,055,076. Current-Generator and Igniter for Internal-Combustion Engines. E. Podlesák, Tiffin, O. Relates to the method of mounting on the engine.

1,055,137. Electric-Lamp Key-Socket. A. W. Clauder, assignor to Bryant Electric Co., Bridgeport, Conn. Relates to the rotary key spindle and switch piece.

1,055,140. Trolley Head. R. C. Cotton, U. S. Army. Is made flexible by means of coiled springs in the jointed head.

1,055,153. Sounding Device. D. B. Ferguson, Aurora, Minn. A hollow casing contains a pendant clapper that closes an electric indicating circuit when the sounder touches bottom.

1,055,157 and 1,055,158. Electrolytic Recovery of Zinc and Manganese. A. G. French, Nelson, B. C., Can. A solution of sulphates of zinc, manganese and sodium is electrolyzed.

1,055,160. Device for Sterilizing Closet-Seats and the Like. K. Gasiorowski, Zurich, Switzerland. A coin switch controls a current for heating a metallic hollow seat.

1,055,165. Electric Battery Cell. J. H. Gugler, Minneapolis, Minn. Has several compartments containing mercury into which the anodes dip.

1,055,173. Conduit for Electric Wires. F. C. Hodkinson, assignor to Safety Armorite Conduit Co., Pittsburgh, Pa. Made from a single metallic sheet bent to form a flat duct with interlocking edges.

1,055,177. Electric-Lamp Switch. M. J. Hoppock, Frankfort, Mich. The upper part of the socket contains a lamp-dimming resistance and an adjustable spring contact finger.

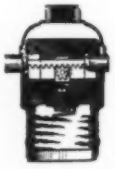
1,055,185. Mercury and Other Vapor Electric Lamp. H. A. Kent and H. G. Lacell, assignors to Silica Syndicate, Ltd., London, Eng. A starting device comprising an auxiliary mercury chamber and heating coil therefor.

1,055,205. Trolley. J. W. McKinney, Tyrone, Pa. The harp has a guide flange on each side of the wheel.

1,055,221. Accumulator. J. Piotrowski and A. Kilinski, New York, N. Y., assignors of one-third to L. W. Schwenk. Relates to the method of connecting, insulating and supporting the plates.

1,055,227. Automatic Alarm. E. Remacle, Newark, N. J. Includes a spring-controlled circuit-closer.

1,055,236. Magneto-Electric Massaging Machine. B. Seacombe, assignor to Thompson & Capper, Manchester, Eng. Rotation of the metallic massage rollers revolves an armature and the current generated is supplied to the roller.



1,055,062.—Push-Bar Socket Switch.

1,055,252. Safety Device for Elevators. B. Baumer, Atlanta, Ga., and C. E. Baumer, Troy, O. An electromagnet normally holds releasing devices out of engagement with a rack in the elevator shaft.

1,055,260. Ignition Device. J. B. Curry, Telluride, Colo. A spark plug with reciprocating plunger.

1,055,261. Electric Welding. J. O. Ellinger, assignor of one-half to Universal Electric Welding Co., New York, N. Y. The parts to be welded are subjected to welding current and to pressure under oil to prevent spoiling the temper.

1,055,272. Bulb. V. Guleserian, Buffalo, N. Y. A lamp bulb with pyramidal filament.

1,055,273. Trolley. H. Habbert, B. U. Nixdorf and A. Rupscheidt, Spring Garden Borough, Pa. Helically grooved conical guides on each side of the wheel and integral with it.

1,055,275. Trolley Wheel. B. H. Hawkins, Brooks, Oreg. Helically grooved cylindrical guides on each side of the wheel and separate from it.

1,055,279. Electric Telephone Recording Apparatus. S. B. Irvin, Los Angeles, Cal. A relay-controlled, motor-operated recording tape.

1,055,292. Electric-Motor Controller for Elevators. J. C. Smith, assignor to American Machine Co., Louisville, Ky. Provides for dynamic braking.

1,055,295. Electrode for Producing Arcs. G. Wagener, assignor to E. I. du Pont de Nemours Powder Co. A modification of No. 1,055,003.

1,055,305. Test-Connector for Electric Wires. A. Kneisel, Cleveland, O. Includes a number of metallic clips.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired March 10, 1913.

555,922. Insulating Support for Boxes Containing Electrical Apparatus. T. H. Brady, New Britain, Conn.

555,937. Conduit-Railway System. O. A. Enholm, New York, N. Y.

555,938. Individual-Call for Autographic Telegraphs. H. Etheridge, Pittsburgh, Pa.

555,958. Traveling Contact Device. M. D. Law, Washington, D. C.

555,959. Underground Trolley. M. D. Law.

555,963. Dynamo-Electric Machine. W. M. Mordey, London, Eng.

555,968. Electric Gas-Lighting Burner. J. A. O'Neill and G. A. O'Neill, Boston, Mass.

555,979. Electric Elevator. H. R. Smith, Chicago, Ill.

555,984. Selecting and Operating Telephone. H. L. Webb, New York, N. Y.

555,992. Electric Meter. C. Wirt, Philadelphia, Pa.

556,007. Automatic Telephone-Exchange System. M. Freudenberg, Paris, France.

556,027. Secondary-Battery Plate. I. Samuels, New York, N. Y.

1,055,173.—Laterally Openable Conduit.

556,028. Circuit Block. D. A. Schutt, Peru, Ind.

556,034. Telephone Speaking-Tube System. J. S. Stone, Boston, and G. K. Thompson, Malden, Mass.

556,038. Electrolytic Apparatus. M. H. Wilson, Brooklyn, N. Y.

556,046. Rail-Bond for Electric Railways. F. H. Daniels, Worcester, Mass.

556,072. Electric Signaling System for Railways. G. L. Thomas, Brooklyn, N. Y.

556,079. Electric Car-Lighting System. A. H. Armstrong, Schenectady, N. Y.

556,138. Electric Gas-Igniter. J. P. Doyle, Buffalo, N. Y.

556,139. Electric Block System for Railway-Crossings. A. E. Ellis, Boston, Mass.

556,183. Electrically Operated Railway-Gate. B. Haberthur, Logansport, Ind.

556,189. Electric Gas-Lighting Device. J. B. Jackson, Philadelphia, Pa.

556,210. Electric Railway. H. C. Reagan, Jr., Philadelphia, Pa.

556,264. Electric Switch. T. W. Gabel, Lancaster, Pa.

556,311. Closed-Conduit Electric Railway. E. R. Desmond, New York, N. Y.

556,315. Electric Snow-Plow. H. H. Kryger, Minneapolis, Minn.

556,320. Electric Railway. E. M. Boynton, West Newbury, Mass.

556,321. Electric Underground-Trolley Railroad. G. D. Burton, Boston, Mass.

556,322. Electric Railway. R. M. Hunter, Philadelphia, Pa.

556,324. Electric Cloth-Cutting Machine. A. K. Thyll, New York, N. Y.